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PROCEEDINGS
OF THE
THIRD
AMERICAN ROAD CONGRESS

UNDER AUSPICES OF
AMERICAN HIGHWAY ASSOCIATION
AMERICAN AUTOMOBILE ASSOCIATION



Price \$1.00 postpaid

DETROIT, MICH.
SEPTEMBER 29-OCTOBER 4, 1913

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Proceedings of
THIRD AMERICAN ROAD CONGRESS

UNDER AUSPICES OF

**AMERICAN HIGHWAY ASSOCIATION
AMERICAN AUTOMOBILE ASSOCIATION**

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THIRD AMERICAN ROAD CONGRESS

Held Under the Auspices of

AMERICAN HIGHWAY ASSOCIATION

AMERICAN AUTOMOBILE ASSOCIATION

MICHIGAN STATE GOOD ROADS ASSOCIATION

Detroit, Michigan, September 29, 1913.

President L. W. Page in the Chair.

THE CHAIRMAN: The Convention will please come to order. The Congress will open with an invocation by the Rev. Dr. Joseph A. Vance, pastor of the First Presbyterian Church.

DR. VANCE: Let us unite in prayer. Almighty God, our Heavenly Father, we invoke Thy divine blessing upon this gathering of men and upon all the deliberations in which they will be engaged, and upon all the issues that shall flow from this convention. Give to them, we pray Thee, great fidelity in the discharge of every duty, a broad vision of the purposes of the Almighty, a great desire to make this earth a better place in which to live while they dwell upon it, and a great joy in the fellowship, in the work of honest men. Bless, we pray Thee, the messages that shall be brought to these gatherings from day to day; may they be spoken with clear vision, with warm heart, with an aspiration for the common weal. Give to the men who gather here and sit in these seats from day to day, a great desire not only to know what will contribute to the welfare of humanity, but that they may give themselves to its realization. We bless Thee for the good roads movements of history. We thank Thee for every man that has tried to fill up a low place and make it level and dig down a rough place and make it smooth and tunnel through mountains of difficulty and fill up bogs and morasses, that the crooked places may be made straight and the rough places smooth and a highway be built on which men may travel with ease and comfort and reach their destination. We pray Thee that this movement may sweep over our nation and that narrow-minded prejudices give way as it advances; that the close-fisted man who wastes his money in multitudes because he is not willing to spend it in little, will be converted and see a better way, and that through it all we may not only move commerce and economize power and bring in added comfort and bring the producer closer to his market, but we pray Thee that, above all, we may learn to build honest roads that will wear for centuries and put in honest stuff, and put into

every road we build every cent of money that the people have given us with which to build it. Give us honesty in executing our trust, as well as a vision of the great possibilities before us. Have in Thy loving care, we pray Thee, our families from whom we are separated. Keep our wives and children safe from harm and bring us safely together again in Thy good time. Pour out Thy spirit, we pray Thee, upon all who are moving for the advancement of human progress and hasten the time when that Highway, which shall be called the Way of Holiness, shall be along every road that men build and nothing unclean shall pass over it. We ask this for the glory of Thy Name, forever and ever. Amen.

THE CHAIRMAN: In the absence of the mayor of Detroit, I have the honor to introduce Mr. Charles B. Warren, who will deliver an address of welcome from the business men of Detroit.

ADDRESS OF WELCOME

BY CHARLES B. WARREN

It affords me, in behalf of the business and professional men united in the Board of Commerce of this city, very great pleasure to bid welcome to this third annual meeting of the American Road Congress. Detroit welcomes the opportunity to have the sessions of these delegates held in our city, because it is interested, as, of course, every group of sane individuals is interested, in good roads.

The problems which you have to solve are really problems of great national importance. The organization, I take it, is for the purpose of preaching the gospel of good roads and studying the economics of road building. It is of primary importance, at this period in the development of the civilization of this great country, that the roads as highways of commerce should be improved and improved speedily and in a lasting and economical manner. The matters you have under consideration go to one of the vital problems of the day, because the burden laid upon the people by reason of the increased cost of transportation enters into the present high cost of living. When we realize that in the older countries, where the construction of the highways preceded the building of the railroads; when we realize, I say, that in the older countries the farmer transports a load for from one-tenth to one-half the cost that the farmer pays in our country, we realize what a vast burden is laid upon our people in unnecessary transportation cost.

When this country was new, it was of first importance that the railroads should connect up the various sections of our great territory. That task has, in a measure, been completed, and it is now of vital interest to all the people that this great organization should give serious consideration to the building of adequate highways, and send out a message to the people that will assist in the matter of the economic building of good roads.

But Detroit is interested in your deliberations for another reason. Her progress and development is now largely bound up in the prosperity of the motor car industry, and these two—good highways and good motor cars—move along side by side. This production in such great numbers of individual power plants which can be used by one person for the purpose of individual transportation and the transportation of the individuals' freight, as against the use of the common system—that is railroad or vessel transportation—is a matter of world importance.

Detroit welcomes to the city your guests of honor, who will be here during this meeting, and especially the member of the President's official family. We hope that through these meetings and through the message that may be delivered to you by the representative of the administration, that some method may be found by which the hand of the federal government may reach out and assist in this great project of good roads.

And Detroit is interested in this other movement—in the Lincoln Memorial Highway. It appeals to our imagination, this idea of a connected, improved highway from the Atlantic to the Pacific, binding many States of the Union closer together. It appeals to our sense of patriotism that this highway should be known as the "Lincoln Highway," for the spirit and the blessed memory of that man binds this Country together as the spirit and memory of no other American who ever lived.

In behalf of the city and in behalf of the business and professional interests of the city I again bid you welcome and trust that you will enjoy your stay with us as much as we will enjoy participating in your deliberations.

THE CHAIRMAN: I have a letter here, which I will read to the Congress.

The Chairman then read a letter from President Wilson, after which Mr. Diehl read letters from the attorney-general of the United States, the secretary of the navy and the secretary of the treasury.

[COPY]

THE WHITE HOUSE,
Washington.

September 10, 1913.

My dear Mr. Page:

May I not convey, through you, to the members of the American Road Congress, which is to assemble in Detroit, my sincere regret that I cannot be present and express, at least, the very deep interest which I feel in the whole matter of adequate road building in the United States. Every man who wishes to see this great country made the most of must sympathize with the efforts now being made to weave its parts together by good roads.

Please present my cordial greetings to the congress.

Sincerely yours,

WOODROW WILSON.

Mr. Logan Waller Page, Pres.,
American Road Congress,
Washington, D. C.

OFFICE OF THE ATTORNEY GENERAL,
WASHINGTON, D. C.

September 17, 1913.

L. W. PAGE, Esq.,
President, Third American Road Congress,
Colorado Building,
Washington, D. C.

My dear Sir:

Permit me to acknowledge receipt of your kind invitation of September 16th, to attend and take part in the sessions of the American Road Congress, to be held at Detroit, Michigan, September 29th to October 4th, and to thank you for the same.

It is impossible for me to anticipate so far in advance my official engagements during the days set for the sessions of the Congress. It will give me pleasure to attend if possible.

I accept this opportunity to say that I am heartily in sympathy with the desire which seems general among our people to secure better roads, and think that the welfare of the nation will be subserved by the success of the movement in that direction, which has already obtained considerable momentum, provided it is restricted within proper lines.

In the event I am unable to be present in person, you are at liberty to use my expressions of endorsement as you think best.

Very truly yours,

J. C. McREYNOLD,
Attorney-General.

THE SECRETARY OF THE NAVY,
WASHINGTON.

September 23, 1913.

My dear Sir:

It was very kind of you to invite me to participate in the Third American Road Congress which will convene at Detroit on the 29th instant. As one sincerely interested in good roads, I should take keen delight in attending this conference and I wish it were possible. Unfortunately conditions are such that I cannot make the trip and I pray that I be excused. I wish to add, however, assurances of my best wishes for the further success of the great work in which you are engaged.

Cordially yours,

JOSEPHUS DANIELS.

L. W. Page, Esq.,
President, American Road Congress,
Colorado Building,
Washington, D. C.

THE SECRETARY OF THE TREASURY,
WASHINGTON.

September 17, 1913.

My dear Mr. Page:

I have your favor of the 16th instant, inviting me to attend and take part in the sessions of the American Road Congress in Detroit on September 29th, and regret very much that on account of the pressure of official business I am unable to be present.

With kind regards, I am,

Sincerely yours,

W. G. McAdoo,

L. W. Page, Esq.,
President, American Road Congress,
Colorado Building,
Washington, D. C.

THE CHAIRMAN: Gentlemen, I am next on the program, but am suffering from such a severe cold that my voice will not permit me to make the remarks I desire to make, so Mr. Colgrove, president of the Michigan State Good Roads Association, has kindly consented to read what I wanted personally to say to you.

ADDRESS OF HON. LOGAN WALLER PAGE

President of the American Road Congress

In a city which, not content with paralleling the best achievements of American genius and industry, amazes the world year after year by surpassing the records of the preceding year, the American Road Congress has chosen to hold this great meeting, which, I firmly believe, will mark an epoch in the movement for better roads throughout the United States and Canada. The welcome which the city of Detroit and the State of Michigan have given us is worthy of the finest traditions of American hospitality, and I am merely voicing the sentiment of the thousands of my colleagues who have come from every quarter of this continent, when I say, "We are glad to be here."

A mighty wave of sentiment for better roads is sweeping over the country, and already the American people have entered upon a road-building era which has no parallel in all history—not even the splendid era when Rome knit together, with massive military roads, the far-flung outposts of her empire, nor the century of constructive work begun by Napoleon, which has given to France the most superb system of highways in the world. Last year more than two hundred million dollars went into the building of roads, and, in a small measure, to their maintenance. Eight years ago the total expenditure was only about eighty millions of dollars, so that we have more than doubled our outlay for roads in this brief period. Not alone in money is this great movement measured, but in progressive and effective state legislation for road betterment. Nearly all the States have established departments of highways, have provided for State participation in the building and care of the highways, and have, in some cases, undertaken comprehensive educational and investigative work, which must result in improved methods and better management. More important, more far-reaching, more vital in its effect upon the nation, as a whole, than other developments in this great onward movement, is the fact that we stand today upon the threshold of a policy of federal aid to road improvement.

For more than a century our ablest statesmen have differed among themselves on the question of Federal participation in the improvement of the public roads. The era of national road building begun in the early days of the republic and ending about 1840, was due to conditions which were not analagous to those which exist today. The western country was filling up with American pioneers, while the great range of the Allegheny Mountains formed a barrier which seri-

ously interfered with traffic and communication between the east and west. The old plan of local assessment for the building of roads could not meet this condition, as the great expanse of country through which the roads must pass was unbroken wilderness. Only a powerful agency, such as the national government, was able to undertake and carry through the project, and thus resulted the first national road, generally known as the "Old Cumberland Road."

Today, conditions exist which, although totally dissimilar to those I have just mentioned, are a justification for extraordinary measures in providing adequate highway facilities. The rapid introduction of the automobile into every section of the country has revolutionized traffic conditions. Villages and towns and cities that were remote from each other twenty years ago, are now, so to speak, on visiting terms. The automobile has brought people close together. The electric railway lines have spread a fringe of suburban dwellers over a radius of many miles about our great cities. The concentration of population in manufacturing and traffic centers has made necessary the transportation of huge quantities of food from the producer to the consumer, and the transportation of immense quantities of manufactured products back to the farm dweller from the city factories. The vacation-loving American has made possible the opening up of summer and winter resorts, and has made accessible the splendid scenery of our continent.

The cumulative result of all these individual forces has been the weaving of a web of interdependence, which reaches every city and every town and every farmhouse. We no longer live for ourselves, but for each other. The country road a thousand miles away from New York City is part and parcel of the life of New York City. In other words, the public highway is no longer a mere local utility. It is a national asset, a national liability, a national responsibility, and the Congress of the United States has come to a realization of this fact to such an extent that the day of federal aid to road construction is at hand. It is the duty of every patriotic American citizen to look upon this question seriously and unselfishly and to aid Congress in the fullest measure, to the end that an equitable and practical law may be enacted. There is opportunity for the parceling out of federal appropriations for political ends, such as would grow into a scandal and disgrace to the nation and be an impediment to the road movement, which would set it back for a century. There is opportunity to turn this great movement into political channels, which would make the aid of the government a farce and seriously endanger the institutions of our government. Think carefully before you give your support to any measure which is branded with the stigma of political expediency.

It seems that carefully-prepared statistics show an outstanding bonded indebtedness of townships, counties and States for road improvement amounting to something over four hundred million dollars. I have heard expressions of alarm at the magnitude of our expenditures. I do not consider that the amount of money we are spending

for roads is in the slightest degree a cause for worry. Our chief concern should be to properly safeguard the expenditure and see that we get results commensurate with the outlay and that the utility which is thus created is so cared for that it loses none of its value to the community, the county, the State, or the Nation. I am informed that last year the people of the United States spent three hundred and sixteen million dollars to see moving pictures. The moving-picture industry is a new one. The inclination for this form of diversion is, therefore, a recent acquirement, so that we have the spectacle of the American people suddenly spending for the gratification of a whim an amount very little less than our total indebtedness for good roads throughout the entire country—an amount sixty per cent greater than the annual outlay throughout the entire land for road improvement and maintenance. If the people of the United States can spend this great sum of money without affecting in the slightest degree their prosperity or comfort, it is idle to talk of even five hundred million dollars a year as a burden too great to be borne.

In my judgment, we cannot too strongly condemn the haphazard issuance of long-term bonds for the building of roads for which no adequate maintenance provision is made, or for the building of roads which are located without reference to the needs of the locality or of the State, and which may begin nowhere and end nowhere, or for the building of types of roads, the cost of which is out of all proportion to the requirements of the community, either from the extreme of expensiveness or the extreme of cheapness, or the building of roads on a large scale without adequate administrative organization, without proper safeguarding of revenues.

Every bond issue should be based upon the most thorough investigation of the needs of traffic, the financial, the State, or local unit, and the types of road and the conduct of the work should be based upon the soundest engineering principles and practice. Above all, there should be clear-cut, effective legislation, adequate appropriation, and efficient organization to insure the most nearly perfect maintenance of the roads built with the proceeds of a bond issue. The bonds should not outlive the road. It is almost criminal to issue fifty-year bonds for a road that is worn out in five years.

There are thousands of antiquated, conflicting, and wholly superfluous laws on the statute books of the various States bearing upon the public roads. It has long been a practice of new members of State legislatures to introduce road bills when they could think of nothing else upon which to expend their activity. The time has come when there should be a concerted movement throughout the whole country to eliminate from our statute books this mass of useless legislation and start anew with clean-cut, concise and effective legislation.

Finally, I wish to express the hope that the American Road Congress may become more and more an annual clearing-house, where the best thought and practice of good roads people throughout the United States and Canada may be exchanged, and started on an

endless chain—so to speak—so that we may all benefit by the progress that each is making, and by avoiding the duplication of effort, so that the costly mistakes which have marked our course in road matters for over a century may not be made again and again. I believe this annual congress is of great benefit to the engineers, contractors, legislators, manufacturers, and finally, the taxpayers, and I look forward to the day when it will be so well established, so firm in the regard of the people, as to be one of our national institutions.

THE CHAIRMAN: The next speaker on our program is Mr. Enos, president of the American Automobile Association, but he has been detained and will not be able to get here until tomorrow, so I shall ask Mr. A. G. Batchelder, chairman of the Executive Board of the American Automobile Association, to give us a talk.

ADDRESS BY A. G. BATCHELDER

Chairman Executive Board of American Automobile Association

This abrupt injection of me into these proceedings reminds me somewhat of the story of an Irishman by the name of O'Brien. It seems that O'Brien, as a contractor, had prospered exceedingly, and in due course of time he moved from a ward down on the river front up into the avenue of the town, and thought that he was going to comfortably settle down. But his two daughters had several years in a boarding school, and when they came back they flatly refused to let O'Brien continue to smoke his pipe in the parlor as he had done in the little house down by the river. So he was relegated to the rear steps. Finally one day O'Brien died, and he was laid out in the parlor. Mrs. Murphy came up from the river district, and standing beside the remains of O'Brien tearfully commented: "O'Brien, you beat them at last; you got into the parlor." Now, Mr. Enos is not dead; he simply could not be here to-day. I am one that the A. A. A. sends into the country to talk roads. Many of you who are here present have had to listen to me out in the West and in North Carolina and in other States, and so I am going to be very brief this morning.

We automobilists, once upon a time, used to half apologize for our participation in this road question until finally we awakened to the fact that we were the men who were using the roads more than anyone else. Of course it was charged that we were wearing out the roads, which, at that time, was undoubtedly true. So we said that if we use the road more than anyone else and if we wear out the roads, it is up to us to get into this road movement good and hard with our work and energy; and, furthermore, as long as we are paying a road tax to use the roads, we might as well wade in and swim in the open and struggle along with the rest of the people. We have also hugged the delusion, that ultimately, most road users were going to be of

the motor driven variety, simply because it was a matter of economics; in other words, if you could in any way save time or save in the cost of transportation, why wouldn't it be simply a matter of cause and effect that the people would, in many instances and wherever they could, become users of motor-driven vehicles. So we find ourselves today mixed up in this movement more and more, and we do not apologize like we used to do. All we can say is that we are trying to do our share of the work, and because we do our share of the work we want you to know this, that we are not interested in the making or selling of any particular automobiles; we simply say that a motor-driven vehicle is an economical vehicle today and we believe most of you are going to use them.

Not long since, I was out in the West, and during the course of a meeting there came up the question of a State highway commission. One man got up and said: "I object to this idea of a State highway commission; do you know that means that some State officer can come into our county and tell us what kind of a road we should put down and how we shall maintain it? I consider that an invasion of county rights." Now, someone did happen to think to ask him what his occupation was, and he rather reluctantly said that he was a county commissioner. Do not misunderstand me. I believe there are many mighty good county commissioners who have done a vast amount of work, and we are going to have many more.

I think that the average man is willing that the State shall relieve the counties of roads that are really interstate in their use, and we simply advance another point when we say that the States themselves are going to look to the general government for a certain amount of coöperation and support in those roads that go from State to State.

I do not know why many of us, interested in this road question, should talk to others equally interested and attempt to convince them, when it is not any longer necessary. You may recollect the story of the parson who when he was baptising a rather belated and elderly convert in the river was interrupted by a man from the shore exclaiming: "Excuse me, parson; I don't mean to interfere with your business, but that old sinner, if you will stake him in the river over night, it will be a much better job." I don't believe that any of you have to have forced upon you the good roads talk, as far as the general proposition is concerned. Later, we will hear a great deal from men who are expert in the construction of roads, men who are interested in matters of finance and other phases of the subject. Hence it would be unfair for me to give you any of that talk now. This convention is going to be the most successful we have ever had in the country. Mr. Page said: "This is a kind of a clearing house," and it is going to meet the needs of the situation better than anything else that has heretofore existed, and when we can get the representatives of our national government to participate with us on this occasion, there cannot be any other than a mighty good result. Thank you.

The Chairman called upon Judge J. M. Lowe, President of the National Old Trails Association, for a few remarks.

Judge Lowe then gave a complete history of the Old Trails Association. He stated that the Old Trails Association was organized for the purpose of illustrating the whole mighty movement toward a magnificent general system of national highways. He called attention to the fact that as early as 1802 it became a serious question whether the government, which had just been organized, should subsist or not; that the Aaron Burr conspiracy which sought to build up a mighty empire in the great southwest, was threatening the dissolution of the Union; that at such a crisis the prolific brain of Albert Gallatin conceived the idea of building a great national highway which would cement the States of the west with the States of the east and thus preserve the American union. The matter was referred to a committee of Congress, upon whose recommendation the bill was passed. In 1802 the first State to be admitted to the Union was the State of Ohio and it was written into the contract of union between Ohio and the other States that 5 per cent—one-twentieth of the public lands situated in the State of Ohio should be appropriated for the building of a road to and through that State. The other States, in forming a Union, had retained their public land and disposed of them as they saw fit, appropriating the proceeds to their own use. No such right was accorded to the State of Ohio and for thirteen years the proceeds of the public lands situated in Ohio were appropriated to building of roads through the States of Maryland, Pennsylvania, and Virginia, and stopping at the western line of Virginia; thus a road, pronounced by Mr. Clay to be superior to the great Appian Way was built over which the mails were carried and over which carriages could be driven at the rate of 80 miles a day. Indiana was then admitted into the Union with precisely the same provision in its contract; Wisconsin was admitted with an amendment appropriating each alternate section in the State of Illinois for the building of public highways. Missouri came into the Union and the same compact was made with her. The result was that the old road was carried through the State of Ohio and some splendid work done there; a trace of it was made through Indiana, and it was not much better than a trace, and not even a trace all the way through Illinois, but at Vandalia, the then capital, the last work accomplished on this old road was done on an old culvert just outside of Vandalia, and there it stopped 150 miles or 200 miles from the eastern line of Missouri. The work in the east went on until 1837.

Judge Lowe, in a very forceful manner, viewing the matter from a constitutional standpoint, drew attention to the parallel question of appropriating enormous tracts of land, larger than the entire area of Michigan and Wisconsin for the purpose of securing a railroad to the western coast, and also the appropriation of \$400,000,000 for the building of the Panama Canal, the latter he characterized as "a magnificent enterprise, a splendid, great public work, and I am glad we did it."

He then made a stirring plea for the building of great national highways by the federal government. He said, however, that he was not absolutely committed to this plan and might be converted to the plan providing that the State, county and township, should contribute an equal amount, dollar for dollar, with the government. His reason for opposing the latter plan was the idea of retaxing the people before they would be permitted to have the benefit of the money that they had already been taxed for, contending that they should be appropriated at first hand by the federal government for the best interests of the people, the more important of which he believed to be the building of good roads.

Judge Lowe further said, "I cannot for the life of me conceive of any great difference in taking the money to build roads out of the national treasury, or out of the State treasury, or out of the county treasury, except that Uncle Sam's pocket is the deepest and biggest and the government has power of taxation that the States and counties have not. He can replete his pocketbook very readily, the State cannot, neither can the county. Now that's the biggest pocketbook and this is our money, all the time, and I am in favor of building roads out of it. . . . If anything is written in the Book of Fate more clearly than any other it is that this government has now reached a point where it is going to take a hand and a large hand in building a system of national highways. It is sure to win, and in my judgment, to win during the life time of the next Congress, not next year, not the year after, not after we old gray-haired fellows have gotten off the stage forever, but it is going to happen in my lifetime and in yours, and we will ride in our splendid automobiles, and will travel around all over this country over a splendid system of national highways."

THE CHAIRMAN: I have the pleasure of introducing Col. Wm. de H. Washington.

ADDRESS BY COL. WM. de H. WASHINGTON

Member of the Board of Consulting Engineers of the State of New York

Mr. Chairman and Gentlemen: I was about to say "Ladies and Gentlemen," but if I were in Kentucky I would consider that latter expression was entirely unnecessary, for I understand that in Kentucky gentlemen always embrace the ladies. So I will only say "gentlemen" and leave it to the gentlemen to embrace the ladies.

I come before you totally unprepared. It takes me fully two weeks to properly consider and get together a real impromptu address, therefore you will have to take just what comes to me as I think upon my feet.

I have not been assigned any topic or text, so shall have to make up my text as I go along. In this state of unpreparedness, I feel very much like the organist in Leadville in the early days of that camp, who used to play the organ in the gallery.

The miners would sometimes get a little too much tarantula aboard, and they'd come to church on Sunday, more out of curiosity than otherwise, and would have a little playful pistol practice at the organist. Finally he had a placard painted which hung over the dash board of the organ top—with this legend upon it: "Don't shoot at the organist; he is doing the best he can." If you will permit me, under these conditions, I will endeavor to say a word or two to you.

It is a wonderful thing to think that where we sit at this moment, a little more than a century ago was but a mere trading-post in the far west. There was not a road or highway within 500 miles of this city.

Our whole western territory at that time was inhabited largely by red men and wild animals, and our progress has all been since then, in fact, I have a map of the roads of the nation a century and a half ago and practically all the then interior highways are marked as warpaths or trails.

In the days of Benjamin Franklin, who was the first postmaster of the United States, he visited every postoffice in the United States and it was not a very difficult job, for at that time they numbered twenty-seven.

We had thirteen States and that was a little more than two to a State. Massachusetts had eight, which was a good deal more than her share, and I believe North Carolina had only one; so you can understand that our development of roads has been quite remarkable, after all, because we had absolutely none when other nations were very well provided.

It has been said that a man is only so old or so young as his arteries. It is equally true, that a nation is also only so old, so young, or so prosperous, as its arteries. Our roads, after all, are the arteries of the nation and the means by which and over which its commerce flows.

We have got to modernize and improve and make young our national arteries, because many of them have fallen into a very sad condition and are very old and decrepit from the standpoint of efficiency.

Time was when the value of land depended upon the distance from the railroad or the market or the means of water traffic, such as our rivers and our great lakes, in the earlier days.

These splendid machines, the automobiles, that are made in this City by the Straits have made the farm that formerly was 15 or 20 miles from a railroad of an almost nominal value, have brought it relatively within 3 or 4 miles or possibly within 2 miles of the station, so far as time and expense are concerned.

If you give the man or farmer a good road to do his work and to get his crops over you have done him the greatest service.

I am not going to give you a dissertation upon good roads and their necessity, but I am going to say just a word to you, perhaps, that will be a little more pertinent than interesting.

I have just come from another road congress, the Third International Road Congress, held two months ago in London, and it was a most remarkable gathering. Thirty-nine nations were represented by between 2500 and 3000 delegates.

It was a gathering that, from the standpoint of language I think would almost put the famed story of the Tower of Babel to shame. All its proceedings were conducted in three languages, but there were gathered together at that time the enthusiasts and road builders of the principal nations of the world.

I want to say in this distinguished presence that it is a disgrace to our nation that the United States was one and the only nation that was not officially represented, because we have passed a law in Congress that the President of the United States cannot appoint a delegate to any international congress without a special act of Congress, I was almost ashamed to be there as an American and find delegates from Siam and from the Strait Settlements, from Jamaica, Asia Minor, South American countries, and I think there was one there from Baluchistan. Certainly the Persian delegate was there and delegates from Turkey, but the United States was not officially represented.

I trust that this Congress will make its voice heard and have a bill passed that will allow us to be represented at the next Congress. After I got through, I took a trip through some of the prominent countries of Europe, and you may like to hear some of the things I found there in the way of road building in comparison with our own progress in the same direction.

We must remember that England and many parts of Europe had roads when American was not known to the white man.

The roads of England go back beyond the Christian Era and the Romans were pretty good road builders, because they built their roads sometimes as much as 3 feet thick and put on plenty of metal and didn't wear them out and couldn't wear them out; so in the foreign countries they have the advantage of us of having had good roads many centuries and having only to add to them.

In England I found them building twelve miles and a half of new road, called the Fosseway, which was the transference of an old Roman road into a modern one, and they told me that was the longest mileage of new road that had been built in this century.

So you understand their problem is largely one of improving and maintaining roads, but in maintaining roads they give us cards and spades and put us to shame, because, in going almost everywhere in England, over 230,000 miles of good roads, I hardly saw a mudhole or a dirt road in all England.

With their little concentrated island about the size of New England, they have about 50 per cent more good roads than we have in all this great United States.

As the richest nation in the world, we should be the leader in this road problem instead of the follower.

The great State of New York, from which I come, and whose highway board I am connected with as consulting engineer, is the leader in the world today in road expenditures. It has appropriated \$100,000,000 for new roads, some \$75,000,000 of which are still unexpended.

This is a greater sum than any nation in the world has appropriated for new roads.

Should it not be that our great State of New York should take the position of leadership that our nation and our Congress is ready to follow.

In the matter of organization of their roads abroad and of their personnel, I think they are far ahead of us. I found every man an enthusiast whom I met, and not a man who is drawing his salary alone, not a man who is looking for the loaves and fishes alone that come out of his position, but he was honestly, earnestly enthusiastic about what he was doing and accomplishing and felt that he was almost doing a holy work.

I met one man who was the engineer and Highway Engineer of one of the counties in England; he was the fourth of his family who had held that office. It had been held before him by his father, his grandfather and his great grandfather.

That man was as proud of his position as a Road Engineer and the office he held, as any man could be proud of being President of the United States.

In France, their great department of roads and bridges is probably the best organized of that of any nation in the world and in Germany they are almost equally well organized. It has a splendid department.

In the same direction, the roads of Switzerland, which is a very poor country, and where, in some cases, the roads are only 6 feet wide, that is, the third class or communal roads, everyone of them is metaled or macadamized, and everyone of them is good to travel over. We must bring ourselves to this same situation. We have got the ranking member of the road committee of Congress with us and a very prominent member of the appropriations committee, and we have also a member of the cabinet.

I think we should lay our plans before them, urge good roads upon them heartily and earnestly and see if we cannot get a great national as well as nationwide disturbance and excitement upon this subject and we will have real progress upon this great road problem and prosperity will follow.

Mr. Diehl in the chair.

THE CHAIRMAN: There are no other speakers on the program for this morning and I thought, unless there is some objection, or other gentlemen here wish to address you, that an early adjournment might be taken, in order that you may be here promptly at 2.30 this

afternoon. The first address of the afternoon is by the secretary of agriculture, who is the direct representative here of the national administration. He is here at the invitation of the officers of this Congress, who called upon the President of the United States about a month ago. It is urged that every delegate be here promptly at 2.30, so that the representative of the government can see our interest in this movement and that he can be enthusiastically and earnestly welcomed.

GENERAL SESSION

UNDER AUSPICES OF AMERICAN HIGHWAY ASSOCIATION

Monday, September 29, 2.30 p.m.

President Page in the Chair.

THE CHAIRMAN: The Congress will please come to order. It is my very great pleasure and privilege to introduce to you the Secretary of Agriculture, Hon. David F. Houston.

ADDRESS BY HON. DAVID F. HOUSTON

United States Secretary of Agriculture

I am greatly pleased to be received in such generous and friendly fashion by this sturdy band of highwaymen. I feel no alarm whatever either for my possessions or life. Obviously, times have changed and we have changed with them. You differ radically from those who used to operate along the highways, at least, in attitude, but if I may judge from some expressions that I heard this morning, there is a suggestion of resemblance as to the holdup, with no little balance to the credit of your predecessors in the matter of the modesty of expectations. I am not here to attempt to convince you of the need for good roads. I might easily consume the time allotted to me in discussing the relation of good roads to rural life, to the increase of production of farm products, their easy and economical distribution, the betterment of the physical conditions of life in the country and its social and intellectual attractiveness. There is no manner of doubt that the rural life problem, so-called, is one of the most pressing and important that engages the attention of thoughtful men.

I am not here to try to convince you of the necessity for good roads or of their economic and social advantages. This would be ridiculous excess, and I shall assume that you are already thorough converts to this idea and that your mission in life is to bring the people generally to your way of thinking. I am here to encourage you in your efforts so far as my presence and few words may serve as encouragement, and to further evidence the interest of the department of agriculture, and therefore of the federal government, in this important undertaking.

You know, of course, that the department of agriculture has been directly concerned in good roads for many years, and since 1893 has been actively engaged in investigative and educational good roads work. The first appropriation made for this purpose was the exceed-

ingly modest one of ten thousand dollars, the bill directing the secretary of agriculture to investigate systems of road management throughout the United States. This resulted in the establishment of the office of road inquiry, whose scope and field of usefulness has been broadened until the department has a somewhat comprehensive organization known as the office of public roads. Without much question the importance of this organization will be further recognized and its activities extended. It maintains laboratories for testing and research work, issues numerous publications of an educational character, and maintains a corps of the best highway engineers and road experts obtainable. It has actively aided states and communities with suggestions or advice, and has made demonstrations of its methods as opportunity has presented. It has aimed to be, in a sense, the last and best word in the nation on matters of road construction and road administration. Its function has been primarily educational, and as such it has been recognized to be of great value.

Recently Congress took a step of great importance and significance. Under conditions specified, it made an appropriation of half a million dollars "to be expended by the secretary of agriculture in coöperation with the postmaster-general in improving the condition of roads, to be selected by them, over which rural delivery is or may hereafter be established," and provided that such improvements should be made under the supervision of the secretary of agriculture. It made this appropriation contingent on the appropriation by the state or the local subdivision thereof in which such improvement was to be made of double the amount of money for such improvement. As the regular appropriation for the office of public roads is approximately three hundred thousand dollars, it will be seen that the department of agriculture has been charged with the supervision of an expenditure for roads of about one and three-quarter million dollars.

So much for the interest and activity of the department of agriculture. Even more striking, of course, has been the interest aroused in the several States of the Union and very marked has been the development. Ten years ago only a handful of States had any expert central machinery to encourage good roads and to supervise their construction and these were confined to the New England and Eastern Middle States. Today twenty-four States have reasonably efficient highway commissions, and thirty-three have central agencies of more or less importance. Ten years ago the appropriation by states for good roads slightly exceeded two million dollars. In 1912, the appropriation was over forty-three millions, which was over 40 per cent of the total estimated expenditure by the States up to December 31, 1911. It is estimated that aside from these federal and State appropriations there was expended locally in 1912 over one hundred and seventy-five million dollars, and quite significantly it is also estimated that from 20 to 40 per cent of this local expenditure was, relatively speaking wasted.

Progress in the last decade is gratifying. It is not singular that this activity should not have been witnessed in the preceding decades. Up to a comparatively short time ago, the people of this nation were pioneering the continent. They were primarily concerned in harnessing the natural forces, in establishing the Union, and in insuring that it should not "perish from the earth." The history of a new nation epitomizes that of the race. At first men must concern themselves with the great problems of existence. Government activities are restricted to the establishment and preservation of order. Developmental and cultural activities are the last to receive attention in a large way. Until population reaches a fair degree of density, individualism dominates thought and action, and only as population and production increase does the sense of community of interest rise and does individualism wane. Theories of government arising out of these conditions pervade legislation and administration. The notion that government is a necessary evil obtains, and that that government which governs least, governs best.

We have passed out of this stage. The notion that the government is essentially coöperation is fastening itself in the public mind, and the conviction grows that things of vast economic and social importance can be done through community agencies with great saving of waste and with adequate efficiency. One gratifying thing today is that people are demanding that their various governmental agencies devote themselves to the vital, essential, economic, and social problems, and when this idea prevails with some universality throughout the nations, there will be some guarantee for the diversion of the resources of the people from the destroying and wasteful expenditure for war to the constructive and helpful expenditure for the development of society. The concrete evidence presented by expenditures for roads, especially by the State or local communities, furnishes encouragement for those who desire to see these communities preserved as vital parts of our governmental arrangements.

No one questions that the States and the localities should largely contribute to the support of roads, and I take it in view of the state of mind of the public, as expressed through its unofficial as well as its official channels, and through concrete legislation, that discussion of the wisdom of federal encouragement and aid would be merely academic. The main questions for consideration are questions of the extent and character of such aid, and of methods and machinery—federal, State, or local. Let us briefly as may be, call to mind certain of the controlling considerations.

The suggestion of great national transcontinental roads appeals to my imagination, as does the suggestion of interstate roads connecting capitals or cities of commercial importance to my logical faculty and to the sense of pleasure that I experience in riding about the country in my friends' automobiles. But that the essential thing to be done is the providing of good roads which shall get products from the community farms to the nearest station and make rural life more profit-

able, comfortable, and pleasurable, I entertain no sort of doubt; and it is obvious that the representatives of the people in Congress are like minded. For in making their appropriation, they stipulated that it should be used in improving the condition of post roads with a view to the economy and efficiency of postal delivery and for the transportation of farm products to the market. Such roads are equally essential to the establishment and operation of decent elementary and secondary schools for the benefit of the country boys and girls. I do not eliminate other things for consideration, and I do not underestimate the rights and pleasures of the automobilists and the service they have rendered in the propaganda for road building.

There are complex problems to be solved in many States before the most efficient expenditure of money by States and communities for roads can be secured, and there are many more to be worked out before one can rationally expect the federal government largely to participate. Who shall say how aid should be apportioned so that the States may receive equitable treatment? Shall it be apportioned equally among the States on the basis of total population, farm population, area, taxable valuation, road mileage, or all these; and should federal money be expended exclusively through its own agencies for a certain system? What roads are to be improved? There are approximately two and a quarter million miles of publicly-owned roads in the nation. Half of this mileage is utilized for post roads and less than 10 per cent of the total can be classed as improved in any large sense. Shall we undertake to apply aid to all the roads, or shall we consider this task too gigantic? Shall we apply it to the rural routes or shall we regard this as equally beyond reason? Or shall we single out certain directions in which central roads shall run, and if so, how? Is it not clear that this opens up a field where petty politics, community interest, and individual selfishness may run riot? Assuming that we have settled this, for what purpose shall the aid be granted, and in what proportion? Shall it be exclusively for construction, exclusively for maintenance, or for both? Shall it be to pay the entire cost of either or both of these items, or shall it be dependent on the equal or larger contribution by the States and communities? Shall the aid come through votes of money out of the treasury or from the sale of bonds?

That the suggestion of federal aid to road building raises grave questions and involves possible dangers, no thoughtful citizen doubts. There are proposals before the public mind which would bankrupt the federal treasury and suggest possible abuses before which those of the worst pork-barrel bills of the past would pale into insignificance. No proposal which does not carry with it the assurance of safeguarding the treasury in this direction seems to me to stand the ghost of a chance of favorable consideration. It is not alone the fear that there would be no stopping place. There is the question of precedent. This is not the only proposal before the American Congress involving the suggestion of huge appropriations. There are others which to

their advocates are just as important and are being just as insistently urged; and many of the veteran Congressmen have naturally contracted the habit of balking automatically at such proposals.

It would be especially pernicious if such aid should result in stifling the spirit of local self-help. In this field, as in others, the States have recently made great headway, and any action taken should unquestionably result in the fostering of this spirit and in the efficient direction of the activities to which it may lead.

Another difficulty to be avoided is the over-centralization of activity in these intimate internal matters and the building up of a great and powerful bureau in Washington, with an ever-increasing control over the highways of the country. The dictates of prudence and experience are that so far as possible, such agencies as may be required should be efficiently developed in the several States and that the federal agencies should work in a spirit of complete and helpful co-operation and assistance.

The first practical essentials in the planning of road legislation would seem to be to recognize the States as the smallest unit with which the federal government might deal. This would give relief in a measure from the insistent demand that would come from every township and every district in the Union for its share of State or federal assistance, without reference to the merits of the case or the practicability of the undertaking. As has been stated, many of the States now have efficient State highway departments, and thus afford organized agencies with which the federal office could deal. It would seem that the basic feature would be such coöperation between the States and the federal government as would leave with the States the initiative in the selection of roads to receive aid, and as much of the immediate construction and maintenance as would be practicable. In the case of roads on which federal money is to be expended, it would seem essential and wise that the federal agency should have the requisite power of the approval of the selection, supervision of the construction and maintenance, and the right of inspection, for the plain and simple, ordinary purpose of seeing that the federal money is applied to the purpose for which it was voted and is efficiently expended.

It is reasonably clear that for every reason there must be some automatic check upon the demands to be made upon Congress, and that this should be afforded through the requirement that the States and the localities should contribute an amount both for construction and maintenance at least equal to and possibly double that contributed by the federal government; and that, in the apportionment of any possible federal funds, a number of basic factors, such as population area, wealth, or minimum cost of construction, should control, I have not the least doubt.

There may be those who "will view with alarm" any suggestion that the federal government coöperate with the States financially in road building, and more especially that it exercise an adequate meas-

ure of control and supervision even over the expenditure of its own funds. The cry of centralization—that the federal government aims unduly to extend its powers, may again be raised. Yet, in a field of common interest and of inseparable activities, what could be more natural than coöperation and mutual assistance? Why should the two jurisdictions serving the same people forever stand apart and view each other with suspicion and distrust while nothing is done or much is wasted? And is it not worthy of note that the alarm never seizes such people at the stage of the discussion in which it would be of most value? They are not in the least timid in their approaches to the federal treasury, and their courage fails them only when it is suggested that the federal government has a right to see that the money of the people of the nation is wisely and efficiently expended. If they are to take counsel of their alarms, let them do so before they determine to assault the treasury.

In short, as a practical program, I believe that this matter is one in which haste can best be slowly made. The people will sanction a reasonable expenditure of their money—and it is their money and theirs only, whether it be expended through the federal government or the State—when they are convinced that it is applied to a wise purpose and will yield the results anticipated. And I am impressed by the wisdom of the action of Congress, in the midst of so much clamor, in constituting a committee “to make inquiry into the subject of federal aid in the construction of post roads, in providing an appropriation of a half-million dollars to be expended coöperatively with the States in the proportion of one to two, and in requiring the secretary of agriculture and the postmaster-general to report to Congress the results of such expenditure “together with such recommendations as shall seem wise for providing a general plan of national aid for the improvement of postal roads in coöperation with the States and counties, and to bring about as nearly as possible such coöperation among the various States as will ensure uniform and equitable interstate highway regulations.” This indicates a wholesome desire to know the facts as well as generous interest. Too short a time has elapsed to judge of the value of this undertaking, but that it is in the right direction, few will question. That it might be extended with ample funds if aid is to be furnished, most thoughtful men would concede; and the plan has the peculiar value of being susceptible of indefinite extension in case the results should be found to justify it.

THE CHAIRMAN: We have the great pleasure of having with us as our next speaker the deputy minister of railways and canals in Canada. As the secretary of agriculture mentioned a few hours ago at luncheon, there was a man in southern Texas who had done more to drive desperadoes off the border than any other man. He came to New York once and went to a banquet. Someone said to him, “Why, how did you manage in chasing these desperadoes when you got them near the line? How were you able to tell which side of

the line they were on?" He said, "There ain't no line when I am after a desperado." Now, we have a distinguished gentleman coming from our good neighbor, Canada, the Hon. A. W. Campbell. It is my pleasure to introduce him.

ADDRESS BY HON. A. W. CAMPBELL

Deputy Minister of Railways and Canals in Canada

I am sure that we appreciated very much the kind invitation which was extended by your department of roads to the government of the Dominion of Canada, to send a representative here to meet with you on the occasion of this, your Good Roads Congress. I was very glad indeed to have been appointed to carry the greetings of that government to this Road Congress and to say that we are working along the same lines that you are working today, with the object of trying to improve the condition of the roads throughout the Dominion. Now, you might ask why I, as deputy minister of railways and canals, should be interested in this question of wagon roads and what knowledge I should have of this great economic measure and upon what authority I can speak to you on the subject. I look upon our system of transportation on this continent as being made up of wagon roads, railroads and water roads or the highways of the sea. These three branches form our great transportation problem, our great transportation system, and no system of transportation in any country is complete without it comprises these three elements, and of these three elements I consider that that branch known as the common wagon road is the most important. In studying this question I find that it is one which requires the very closest possible attention and involves the lifework of any individual who expects to become an expert and who, as such, can speak with authority, and in that very comprehensive address which has just been delivered by your honorable secretary of agriculture, you can easily see that he has grasped the whole situation, has summed it up in that brief and concise manner and has struck the word of warning which must be taken to heart and considered by everybody, whether he has to do with the actual construction and maintenance of roads or not. I am a civil engineer by profession and for fourteen years I devoted my time as a road commissioner in the Province of Ontario, to this question of road improvement or this movement for better roads. Since that time I have been devoting my attention to the other branch of transportation, known as the railway and waterway, but still I consider that my studies have been along the same line and that notwithstanding the fact that I have planned nearly a quarter of a century in connection with this great problem, I am still a student of it, and your worthy president, who is looked upon as being the greatest authority in road mak-

ing today on the continent of America, will tell you that while he has practically spent a lifetime in the study of this question, yet there are phases of it which are new to him and which he still is studying and trying to get more light upon. The ramifications of the transportation system are so great, that any plan which must be laid down in order to meet the requirements of road improvement in the different sections of the country is so extensive or so comprehensive that it does require the study of a genius and an expert from every class of the community to sit down as one committee and thresh this thing out, and still we will be lacking in some respects all of the knowledge that is required to solve properly, capably and efficiently, this great question. Now, sir, I am still a student, and, like the desperado mentioned in the incident related by your president, whenever a good roads congress is convened in the United States, it seems but natural that if we in Canada receive an invitation, that we should attend, regardless of the fact that it may be held in another country. I come across here from Ottawa to Detroit without thinking that I am crossing a boundary line, and I come in here to discuss this question and to absorb some of the information which you are retailing, with the greatest possible ease and comfort, just the same as I would go into one of our own municipalities and hear the matter discussed there. I am not forgetful of many pleasant occasions on which I have met in conference the people of the United States on this problem and I certainly feel deeply thankful for many of the profitable suggestions which I have received at these meetings and carried home to be given effect to in our own country for the benefit of our people, and if at any time I should happen to drop some suggestion that might be of benefit to you, I will only feel that we are paying some small percentage of what we have received by way of valuable information from your people and from your very capable department of roads at Washington. Now, sir, why should I say that the question of common roads is as important as that of railroads? Simply because the common road is the feeder of the railroad and the railroad is the feeder of the steamboat line. Close up the wagon roads of this country and the railroads would die of starvation. Your great ocean freighters would rot at their moorings, yet before the era of railroads great civilizations prospered. They had, however, good wagon roads. That is why I attach so much importance to the wagon road end of the transportation system and that is why I say that the very best brains and minds of the people of this country can afford to apply themselves to a study and consideration of this question. The very figures which were mentioned by the honorable secretary today show you the enormity of the problem and show you some of the difficult phases of this question, when we come to consider that great problem of national or state aid. If we would undertake such a plan as he pointed out, what roads are to be improved? How are we to base the assessment? Is it on population

or assessed value or on area, with the minimum or the maximum applied? He has sized up the situation in a nutshell there and that is one of the difficult problems that we are confronted with today. How is the tax to be levied? What roads are to be improved and upon what basis is this levy to be made. This question, however, you will discuss and this is a question which you will solve, because it is true that wherever you find that there is a necessity for improvement or where a great national work should be carried out, it is surprising how quickly you, on this side of the line, determine the ways and the methods, and it is surprising how enthusiastic you are in seeing that it is carried as quickly as possible to a final result. We are watching you closely in this connection. We are going to try to follow some of the suggestions that will be made at this meeting today, because we require suggestions in this connection, but we are anxious, you are anxious, that if federal aid or State-aid for road improvement is to be adopted in our country, that the plans will be thoroughly considered and properly matured before any money is expended, to secure that a dollar's worth of results will be produced with every dollar that is expended. It is an unfortunate thing today, but it is one which must be admitted by every citizen who gives the question the slightest thought, that in our country as in your country, on the roads generally, I am speaking now, millions of days of labor and millions of dollars of the people's money is being wasted and practically buried in the mud. The result is useless and it would be better for us to have conserved our labor and have saved our money than to have undertaken a great percentage of the expenditures we have made. Unfortunately, now, in connection with the ordinary roads, we are not giving them the thought and consideration which we should. Many of us here today are disposed to consider the great question of national roads or expensive roads, and it would appear as if we can afford to devote our time to a consideration of these, because they involve large outlays and the expenditure of thousands of dollars per mile, but that to give attention to the ordinary road would be so commonplace that it is useless for us to think about it. The ordinary roadmaster or pathmaster in the parish may look after the common road, but as soon as it is determined to spend millions upon the through roads, then we, as engineers, are prepared to take a hand in that connection. I think it would be well for us to consider carefully and well how should the ordinary road be improved, then how should the next class of more importance be improved, and then how should the interstate or intertown road be constructed in the most capable and efficient manner so as to provide the least resistance to the traffic passing over it? Now, in any of these connections it is advisable that we should carefully plan the work. That building of the lateral road, the artery leading back into the farm yard with a few hundred dollars per mile, requires careful planning, careful supervision and careful attention, and if we are

to consider the question carefully we will determine that these lateral roads are deserving of just about as much consideration as the more important roads. When it comes to the more important road, it appears as if we can find plenty of experts who will spend their time in planning and supervising these, but let me say in that connection that whatever expenditure is to be undertaken, before we commence that expenditure we should see to it that provision is made for a proper system of maintenance by which these roads will be cared for and this investment will be protected, and the work which the people are taxed for, especially of the more expensive character, should be looked after in that systematic way that the maintenance will be reduced to a matter of repair by never allowing the road to get out of repair. The stitch in time in this connection is worth millions to us and no suggestion of the expert today can be more important than that we watch the road carefully and see when it commences to unravel or when a rut appears on the surface or when the slightest little repair is required; have it attended to. That is the time to make the repair, not after the road has become impassable and requires an expensive outlay to bring it back to condition. Now, in many of your States, as with us, carried on by this agitation, we find that a good deal of temporary work has been done; the ordinary, waterbound macadam road has been constructed, and in our desire to improve a great mileage to satisfy the people, at least for the present, we have gone on spending large sums of money, only to find that these roads have not been built sufficiently permanent to withstand the heavy and rapid traffic which they are subjected to at the present time. The automobile of today, with its very heavy load, requires a very strong road to support that load, and with its rapid movement, requires that this surfacing should be bound together in a manner that will not unravel or be shifted by the speed of these heavy, fast-moving machines. Even the change in the class of traffic has brought us face to face with the study of almost a new problem in connection with roadmaking and in my time this phase of it certainly is one of the most difficult. How we should construct—I heard a man one time say that he could make a road with 6 inches of material, good, hard, tough broken stone, that was just as serviceable as 16 inches of material, because it was argued that it was the earth foundation that carried the load and that the broken stone was simply placed there to form a crust or a surface to withstand the wear and to shed the water, but that the foundation carried the load. The experience of the older countries in road building for centuries has demonstrated that that road must be of sufficient strength to carry the load and that the strength of the road must be in keeping with the maximum load that passes over it, not the mean, not the minimum, but the maximum, and that at the most trying season of the year. In the older days, these roads were built from 18 inches to 3 feet in thickness and built of large stones laid in the bottom, following with a smaller grade, until it is surfaced with the

finest material; that binds the whole together, but the large stones, up to 2½ inches in diameter, must be brought as nearly as possible to the surface; then the surface must be bound with the finer material and this should be cemented together by the use of either some form of bitumen asphalt or cement. Which of these is the better for the much traveled roads, for ordinary work, for the primary road, is a question I want to hear discussed. It is not yet settled and it will, I think, take even more meetings than this to settle it to the satisfaction of all, but it is a very important question in connection with your deliberations here, and it is one of the questions that I am chiefly interested in and I would be very glad indeed to have it discussed and to hear it discussed before I go away. I am delighted to be here, to have this opportunity of hearing Secretary Houston sum up this whole problem. I am sure that I carry greetings across the border with me to the Canadian people and the Canadian government. We are working along the very same lines, the lines for improving or making better the condition of the common highways throughout the country. These lines, no doubt, will be classified among parish and county, intercounty to state roads, interstate roads to national roads and national roads that will end way across this border, joining together the two sections of the great American continent, and let us hope and wish that these roads may be used for the peace and good will of all those who wish to freely travel on them.

THE CHAIRMAN: It is our pleasure to have with us a man who, at a road congress, needs no introduction; Colonel Sohier, chairman of the Massachusetts highway commission.

LESSONS LEARNED AT THE RECENT INTERNATIONAL ROAD CONGRESS IN LONDON AND OBSERVATIONS OF FRENCH AND ENGLISH ROAD SYSTEMS

BY COL. WILLIAM D. SOHIER

Chairman Massachusetts Highway Commission

The Third International Road Congress was held in London the week of June 23-28. Some twenty-five hundred delegates attended, representing countries all over the world. The leading road engineers of the world were present, and the papers, which were printed beforehand, were most interesting. I, and I am sure every American delegate who attended, felt amply repaid for the trip by having the opportunity to meet so many distinguished engineers representing so many countries. Personally, I learned more by meeting and talking to these engineers than I did at the sessions of the Congress itself, where there was not time for full discussion because the subjects covered too broad a scope to make discussion of details possible.

I am sure I am speaking for the American delegates when I say that I feel it was a shame that the United States should not be officially represented and should not be a member of this International Road Association.

The United States has not joined as a nation and was, therefore, not represented by delegates representing the nation. This was mortifying to all of us, and I believe it was bad for the country itself.

All the European countries and England not only belong, but were represented by large numbers of their leading engineers, men who would rank with any of our engineers in this country. It would seem to them as if the United States was not a nation, but merely an aggregation of States, to find that she was not represented and had not joined.

I personally represented the State of Massachusetts, and many of the other delegates represented other States. The State of Massachusetts joined the Congress as a State; and, out of courtesy, not as of right, our delegates were recognized. It should be a right and not a courtesy.

By having Massachusetts, New York, and other States represented in this way, by courtesy of the convention, merely puts us on the same footing as Siam or Borneo. It was very mortifying, and I believe, very poor policy for this country. I hope that all members of this Congress, representing all the States in the Union, will join with me in my endeavor to see to it that this is rectified before the next International Road Congress.

RESOLUTIONS ADOPTED

We could well study the resolutions adopted by this and the former International Road Congresses. Naturally these resolutions are very conservative, because they have to represent the diverse views of various countries where conditions and road systems are totally different. Therefore, the resolutions should be carefully studied, and followed almost everywhere. In some places it would be well to go further in the same direction. I will only mention a few of the resolutions adopted.

PLANNING OF NEW STREETS AND ROADS

1. On general principles it was decided that new main roads on through routes should be constructed by passing outside rather than through the small villages. This would make the road safer and would be much less expensive than a wholesale tearing down of buildings, which would be necessary to get sufficient width in the villages.

2. Grades should be as easy as possible, especially where there was much heavy traffic.

3. Curves where there was fast traffic should provide the best possible view and the longest possible radius. When a short radius was inevitable there should be marks showing the danger.

4. Street railway tracks, if they could not be placed in a specially reserved place, should be in the center of the road, and space should be provided on either side for two tracks for vehicles.

5. In laying out new main traffic roads sufficient space should be allowed for what may ultimately be required, like street railway tracks room for fast and slow traffic, etc.

6. The planning for these main roads of communication should be undertaken at once, and it was important that central State authority should take interest in the matter and be given, to some extent, the supervision and authority.

There were so many other resolutions adopted that I cannot mention them in this paper, but they will amply repay study, covering as they do "Types of Surfacing to be Adopted on Bridges, Viaducts, etc.;" "Construction of Macadamized Roads and Bituminous Macadam Roads," with full particulars as to the way of building, materials to be used, and how to use them; resolutions as to wood paving, methods of lighting highways and vehicles; and conclusions regarding various causes of wear and deterioration of roadways noted since the 1908 International Road Congress.

I might note in this connection that the resolutions recognize the fact that the high-speed, light motor vehicles rapidly destroy water-bound macadam roads, but did not cause serious or exceptional wear or damage where the roads had been properly treated with some bituminous material, except on curves. Also, that it was most important with heavy traffic that the width of tires, the diameter of the wheels and loads to be carried should be regulated.

A resolution was passed relating to the regulation of fast and slow traffic to the effect that some authority should be established to regulate and direct this traffic at all congested points, and that the regulation should define the rights, duties, and responsibilities of each kind of traffic, including not only vehicle traffic, but pedestrians.

A resolution was adopted that the unit of highway administration must always be sufficiently large and should command sufficient money so that a competent staff of engineers could be employed. This question is of great importance in this country; in fact, of more importance it seems to me than any other, because I believe that in many places the public money spent on roads is largely wasted from the lack of proper engineering advice and adequate supervision.

I would call special attention to one particular resolution, as it seems to me most important at this time in this country where so many States are borrowing money, and even the national government has considered entering into the work of road improvement. This resolution is to the effect that borrowing money for new main road construction is only consistent with sound financial principles provided the loan period, in the case of loans for renewals is kept well within the life of the surface coatings, and of course provided also that the loan period is kept well within the life of the road, or enough of it is paid during that period to cover the deterioration of the road surface.

ROADS IN FRANCE AND ENGLAND

I spent about ten days in learning all that I was able to about the roads in France, and the same in England, in addition to special trips which I made to see particular pieces of roads, particular pavements, etc., in and around Paris, London and Liverpool.

I examined something over one thousand miles in France and the same number of miles in England. While I recognize fully that this did not give me sufficient opportunity to really be familiar with road systems in France and England, and therefore my observations are not conclusive, I feel it may be worth while to present a few of them which were interesting to me and may, therefore, be interesting to other road builders.

THE COST OF A ROAD SYSTEM

We must not expect too much in this country, where we have some two million miles of public roads. We must recognize the money which will be required and the time which must elapse before we can even think of attaining the position that France and England now hold in regard to roads. Their roads have been built for years, and to a large extent they have been built of macadam for years.

In France practically all the roads are already built and very few new ones will have to be built. Their whole problem is one of maintenance.

It would be well for us to consider the magnitude of the problem.

France has about twenty-five times the area of Massachusetts, and has about twelve times its population. Practically all over the country its roads are laid out on a uniform width, and are of almost uniform construction of some form of macadam. All road work is done under the supervision of the government engineers.

France has about 24,000 miles of national routes and 8,000 miles of departmental routes. It has over 107,000 miles of what might be called country roads, 47,000 miles of roads that interest several communities and 184,000 miles of country roads. Their total road mileage is 371,700 miles, and it cost \$1,663,000,000 to build it.

We must remember that their roads were built years ago when land was cheap and when their labor was much cheaper than now, and that their labor cost today is not more than half the labor cost in most parts of this country.

Even with their low cost of labor their national roads cost something over \$12,000 a mile; departmental roads \$7,700, a mile; county roads, \$6200 a mile, and their local roads about \$2500 a mile, or an average cost of nearly \$4500 a mile.

But most important of all is the fact that the annual maintenance of these roads costs nearly \$45,500,000 a year, of which \$6,500,000 is provided by the national government and \$39,000,000 by the eighty-six departments. The amount furnished by the departments is practically \$1 per year for each inhabitant, man, woman, and child.

To secure any such road system in our little State of Massachusetts, with her 23,000 miles of road, means years of work and over \$100,000,000 in money. At the smallest calculation she would have to spend \$5,000,000 a year for the next twenty years to build her trunk lines and secondary roads alone.

I think we can, however, all profit a great deal by studying the French road system. The most important lesson of all that they teach us, it seems to me, is that we should secure proper locations for our highways, sufficient width for all future use (their main highways are 60 feet in width), and wherever possible we should secure that width in our location.

The macadam on the national routes is 24 feet in width, on the departmental roads 18 feet, and on most of the other roads about 15 feet. There is a grass shoulder on each side, about 15 feet in width.

Of course I have not time to give more than a few general observations.

The first and most important is that they are spending over \$45,000,000 a year for maintenance on 371,000 miles of road. This is about \$125 a mile a year; and we must remember that all of their roads have been built for years and are practically today all waterbound macadam roads, where they have not already put in some more permanent form of construction.

I see by the papers that their minister of public works is now recommending that \$50,000,000 additional be provided to be used during the next ten or twelve years for some bituminous binder on some 6000 miles of national roads. I may say in passing, it is greatly needed.

France has undoubtedly the best road system in the world so far as location, layout, foundation, drainage, etc., are concerned; but where there is much motor vehicle travel—and that is near the cities—their macadam roads are going to pieces, and just as fast I think as our waterbound macadam roads have in this country since the advent of the motor vehicles. Wherever the motor traffic is heavy, near the cities, I found the macadam roads extremely rough and going into pot holes as they are here; but it is only fair to say that this observation would not cover many miles of road in all out of their 371,000 miles, because, especially near Paris, they are already using tar or some bituminous binder, either in construction or as a surface coat.

One noticeable thing in both England and France was that except near the cities one did not meet even 10 per cent of the number of motor vehicles that one usually encounters here, at any rate in the eastern States. This accounts for the fact that their waterbound macadam roads have stayed in such good condition.

Traveling as I did on the main routes in Touraine through the chateau district, Brittany and Normandy, which are very popular, I think I often did not meet more than ten or twelve motor cars in 100 miles, and there were very few teams except near the villages.

As we all know in France they have a patrol system. You still see the piles of stone on the roadside ready to be broken up and put on the road, but in the whole 1000 miles which I went over, on perhaps only four places—less than a quarter of a mile each—did I see any dry stone put upon the road to fill the holes, and in these instances it was scattered over the road by the motor vehicles as it is in this country.

They have found it necessary there to use some binder in their patches, and in both France and England on their main roads I found they were using tar. They were painting the bottom and painting the stone with tar, and covering with sand, or filling in with stone that was already coated.

It was evident to me that in neither France nor England can they maintain waterbound macadam roads where they have more than fifty automobiles a day, and keep them in reasonably good condition, without the use of some bituminous material.

Every road that I saw in France had a ditch on each side to carry the drainage. This ditch was usually placed beyond the 15-foot grass shoulder, and had waterways connecting into it.

On almost all of the main roads where there was a grade of 3 per cent or more, they had a shoulder on the side of the macadam and a paved gutter about 4 feet in width. This was made of larger blocks of stone than ordinary paving stone.

One very noticeable thing, and one that we could well copy, was that the gutter was laid out on almost the same crown as the road, so one could travel on it without any inconvenience.

The crown of the roads there was flatter than ours, not more than $\frac{1}{2}$ inch in the foot; often less.

I saw many places in the villages and in the parks near Paris where the gutters were across the road. These gutters were constructed so wide, and so shallow, that at any reasonable rate of speed (say 15 miles an hour) an automobile would go over them without having anyone inconvenienced, even in the back seat.

ENGLAND

I must pass on to English roads.

In England they have a different road system than that of France. The county boards and county engineers have charge of the main roads outside villages, though the central government is now helping to improve main roads, and has a competent board of engineers to advise on the kind of improvement to be made.

The central government has some \$5,000,000 a year with which it is helping its counties to make improvements. This, by the way, is secured from a tax of 6 cents a gallon on gasoline, and from the motor vehicle fees, which are extremely large; for instance, a 40 h.p. Packard would be taxed about \$110 a year in England, and other cars in proportion.

I should judge that England had on its main roads much more motor traffic than there is in France; although even in England, so far as I went, there was very much less motor traffic out in the country than there is in this country, though there is a tremendous motor travel near the cities, particularly in London.

What is particularly noticeable in connection with the English traffic is the tremendous number of traction engines and trailers, which one meets everywhere, hauling 8 to 10 tons, on iron tires.

I understand from their engineers that this kind of traffic will rapidly cut through and destroy any macadam road which is less than 5 inches in depth. So far as I could learn, they are now building most of their heavily traveled main roads of at least 9 inches of macadam, the top 3 inches of which is made of bituminous macadam or a tarred slag.

In and around London they have tremendous numbers of motor 'busses, which travel in rubber tires, and often go 10 to 25 miles out in the country, with a five minute service. They are practically like our 6 ton trucks.

The road surfaces there are remarkably good, and they have now about 40,000 miles of road where the surface has been coated with tar. On the whole, I should say that their road surfaces on main roads were much better than those in France because they have used much more tar and bituminous macadam. In England and in France they are covering all their tarred surfaces with sand, gravel or pea stone and dust.

On the other hand, the English layouts are inconceivably bad. Their roads, even on the main lines of travel, are extremely narrow, and the corners very blind. Often there is not room to pass the traction engine that one so frequently meets.

I hardly expect to be believed, but I went over very many miles of road where the road ran between banks, or between walls, where there was absolutely not room to pass sometimes for from an eighth to a quarter of a mile, and then one could only pass at a turnout. I measured several such roads where the distance between banks on the road was only nine to eleven feet.

The surfaces, however, were almost uniformly good except near the cities where the motor travel was heavy; and here again the water-bound macadam road was full of holes and rapidly going to pieces when it had not been treated with tar. It is only fair to say, however, that most of them were treated with tar. Right near Hyde Park in London I saw as rough a piece of macadam road as one could find anywhere in this country near any of our cities.

One of the most noticeable things about the English roads, as with the French, was that the whole width of road surface was made suitable for travel from shoulder to shoulder. This, of course, was necessary in England where the roads are so narrow.

The most severe criticism on the English roads today would be that they have not sufficient width, have very bad corners, and in many

places not only no sufficient provision for drainage, but practically almost no provision whatever.

Many times it looked as if the road was going to carry the water from the surrounding country, and would be something more like a drainage canal than a road, in a heavy downpour.

They have, however, realized the importance of the drainage problem and are rapidly making great improvements.

MAINTENANCE

We can learn a great deal from the English in the matter of maintenance. With a total of over 150,000 miles of road in England and Wales, they classify as *main* roads 27,800 miles. The average cost of maintenance of these 27,800 miles of road is \$475 a mile a year. We should remember this in this country.

Ninety-five thousand miles of road in England are maintained by the local authorities; they are called *rural* roads. Even on these roads the average amount spent for maintenance per mile a year is \$115.

Remember that their labor costs much less than in this country.

On 2173 miles of road maintained by the London authorities (not including the London County Council), the average cost of maintenance is \$1675 a mile a year, or that was the cost some years ago; I am informed it has substantially increased since that time.

No wonder they can keep good surfaces.

The engineer in the County of Lancashire, Mr. Schofield, told me that he had something over 600 miles of road to maintain, and that this year he had an average of \$1500 a mile for maintenance. Of course, we must remember that "maintenance" means not only ordinary maintenance, but includes resurfacing and even reconstruction.

Mr. Schofield told me that many of his roads had an average of from 50 to 75 traction engines, hauling trailers, going over the road every day. He said they had absolutely destroyed the 6 inch water-bound macadam road, and that he was reconstructing his roads with what we would call a telford base and 9 inches of macadam, with the top 3 inches made of bituminous macadam. To build a road of this character in Massachusetts would cost from \$20,000 to \$25,000 a mile for a road 18 feet in width.

In the towns that I went through in his county he was building granite block pavement grouted with cement laid on a 6-inch concrete base.

OTHER LESSONS

I can only give a very few observations of the other things that I saw.

In England and France I saw many places where resurfacing was going on. They were uniformly resurfacing with what they called a granite, either Belgian or Welsh; what we should really call a trap.

What impressed me particularly was that if they resurfaced at all they used what we call a No. 1 stone, at least a $2\frac{1}{2}$ - or 3-inch stone, and only about 10 per cent of the finer stone. This was true wherever they were resurfacing.

In France where I saw them resurfacing they were generally using stone alone, but in England they were putting on slag, coated with tar, of this large size, or a 3-inch stone coated with tar.

Their method was to lay this stone, what they call one stone deep, roll it slightly, and then roll in 10 per cent of No. 2 and some chips coated with tar.

I saw several of these roads, which carried very heavy traffic, that were in very good condition indeed, although three or four years old.

In Liverpool I saw one tar macadam road built by the so-called "Brodie method," which is to grout the top 3 inches No. 1 stone, when it is rolled, with a mixture of equal volume tar and sand. The sand is heated to the temperature of the tar, the mixture kept agitated and poured evenly into the stone until it flushes to the surface, and then 10 per cent of No. 2, or finer stone, rolled in. This road was eleven years old, and still in very good order, whereas a waterbound macadam road, just beyond, carrying the same traffic, had been resurfaced three times in eleven years, and today is rougher than the tar macadam.

ROADS NEVER CLOSED

I was informed that they never close the road in England or France for resurfacing. Personally, I must have gone over at least one hundred places where the roads were being resurfaced, and invariably—whether it was waterbound macadam, tarred macadam or tarred slag—they were repairing one-half of the road only and left one-half over which one could pass reasonably comfortably.

In some instances where they were laying tar macadam they held the middle of the road with timber. Near London they had a policeman at each end of the section where the work was in progress, and vehicles went through in single file. This particular road had so much heavy travel that each of the four times I went over it I should think there were at least twenty vehicles, two or three of which were motor 'busses, that had to wait until the other line got through.

The method by which they did this in the country, however, was to spread their stone or tarred stone, or slag of large size, over half the road, and roll it lightly, then put on the finer material and roll that, then spread the other half.

Four or five places where I inquired I found that they did very short stretches at a time, and at night finished up with a square end.

At no place in either England or France could I discern any line in the middle of the road where the joining came.

In England the crown was only 1 inch in a yard and the surface almost invariably went from bank to bank, wall to wall, or shoulder to shoulder, so that one would travel over the entire width of the road.

In England, as in France, the patches they were putting onto their macadam roads were made of tar on all main roads. They did not try to patch with stone alone.

There is still another observation I would like to record, and that is that the tars in England seemed very much more lasting and elastic and more sticky than ours.

I only saw possibly one mile of road in all where the tar surface seemed to be picking up; in other words, where the stone showed below it, and in that instance it would undoubtedly be patched at once and before a pot hole came. With that one exception, their tar surfaces were practically perfect. There were no pot holes, and when one dug into the tar it always seemed alive, sticky and soft.

In the past I heard several things that I think are not so now. One was, that they coated their roads with tar in England and France and did not cover the tar with sand or dust. This I think is not true; first, because I saw the sand cover used everywhere, or else a covering of pea stone and dust. On every road I examined or passed over a covering had been used. Also I inquired of the engineers of the English road board, and they told me there was only one county left in England and one engineer now who thought he could put on tar without using a cover. All the others said they had to use the cover to prevent damage to clothes and vehicles, and most of them believed it added to the life of the road.

Another thing: On only a very few miles of road was there any of that mosaic effect that we had been told about. The engineers tell me that that effect came the first year when they had used only say one-sixth of a gallon of tar per square yard, and where it had worn off on the tops of the stones, but when they received a second application, with sand covering, it made a blanket coat just such as we have in this country.

Most important of all, the English roads are constantly maintained. Remember the money available and necessary on the main county roads; two counties with \$1500 a mile a year.

In Massachusetts we find we can maintain our oil and tar surfaces most economically by having a team and two or three men constantly patching from 6 to 8, or even 10 miles of road. If this work is well done we never have any holes.

Another important consideration was that in both England and France all road work is in charge of competent, trained engineers, who not only have technical training, but many years of practical experience. They stay in office as long as they are competent and efficient; it is not a matter of politics. They have entire charge of road building and road repairs, and employ efficient foremen and workmen. These facts largely account for the results obtained.

STREETS WHEN BUILT ARE NOT OFTEN DUG UP

Another most valuable lesson, that most of our cities, especially, could learn from the practice in most of the cities abroad, and that is to leave your street surfaces alone after they are built.

When this is impossible, and the street has to be dug up, the street department re-lays the pavement or surface, and collects the expense of putting the surface into good condition again and maintaining it for a reasonable period of time.

Water pipes, local sewers, gas, electric conduits, etc., should be so located that they can be connected with the buildings without disturbing an expensive street pavement.

If this cannot be done, then the authorities in charge of the streets should, as I said before, do all necessary work to put the street surface into good condition and the cost should be borne by the company or department which required the digging.

Thousands, and perhaps millions, of dollars are wasted yearly in this country in building roads and streets only to have them dug up and made nearly impassible in a year or two.

It is no unusual sight in my State to see a street dug up twice or three times in one year, and it is hardly ever properly repaired. In consequence, paved streets that would have remained in good condition twenty to forty years, have to be reconstructed in five or ten years at enormous cost. In the meantime they are in wretched condition.

The time has come, in my opinion, when no one should be allowed to dig up our roads and streets anywhere, no matter how influential the corporation or individual may be, without their having to pay to the department in charge of the road, enough money to put the street back into its former condition, and keep it there.

Perhaps the best way would be for the street department to collect a uniform amount for each square yard of street surface disturbed, the amount to be collected differing with the cost of repairing and maintaining the trench on the different classes of pavement or surfaces.

CONCLUSION

In conclusion, I would not discourage any "good road" movement in this country, but we must go at it in a proper and scientific manner and know what our problem is before we tackle it, then proceed in a businesslike manner to build our roads.

We must realize the enormous amounts of money involved, and we must also realize the tremendous amount of money that is required to keep the roads in good condition after they are built.

In my opinion we have engineers who can do as good work in this country as anyone has done abroad. We can build equally as good roads.

We may even learn to build them better, but we must realize that it requires education, skill, intelligence, and experience, and that constant maintenance is absolutely essential.

Maintenance begins the day the road is built, and continues as long as it is used, and the money for maintenance must be provided as well as the money for construction, or we shall find that the bonds issued to

construct our roads still remain to be paid while the roads have passed away in dust long before.

The money cannot be provided nor the roads built at once. If we are to secure good roads we must all join hands, the town, the city, the county, the State, and possibly the Nation also, but it must be upon a carefully prepared plan made by competent engineers, after a full study of the whole problem. Only by coöperation can our country secure any comprehensive highway development within the next twenty-five years.

THE CHAIRMAN: At the present time there is great difficulty in securing highway engineers, but fifteen or twenty years ago there were even fewer, and the majority of the engineers now have accumulated a great part of their knowledge under the tutorship of the next speaker, who, for many years, built highways in the State of Connecticut, who is recognized as a highway builder of note, who is recognized as a good roads advocate, who is second to none in enthusiasm and energy, who is going through the State of Pennsylvania today, campaigning for the \$50,000,000 appropriation, a man who organized the Road Builders' Association, and a man whom good roads enthusiasts all over the country delight to honor. It is a pleasure to introduce the dean of the highway engineering fraternity, Mr. James H. MacDonald, of Connecticut.

ADDRESS BY JAMES H. MacDONALD

Former State Highway Commissioner of Connecticut.

I remember when I was quite a small boy, and that was more than twenty-seven years ago, my father, who was very religiously inclined, took me to class meeting with him, and he specially enjoined on me that at the next class meeting I should have to stand up and speak to the brethren and sisters. Not knowing as much as I do now about public speaking and what an effort it is at all times to do so, I consented. I remember that during the week I prepared myself for the little occasion and when the eventful day came and the hour and the meeting, I got up and said, "Brethren and Sisters," and then I forgot all about what I had so carefully arranged, and a dear old sister in the back of the room started that old, familiar Methodist hymn, "Tongue cannot express the sweet comfort and peace of a soul in its earliest love," and I wanted to hug that dear old lady just at that moment. I had arranged in my mind some little thoughts on the subject-matter that had been assigned me, but after hearing the very eloquent remarks of the gentlemen who have preceded me and the intelligent interlarding by the very eloquent chairman, I find myself just about in the same position as at that little prayer meeting.

Truly history repeats itself, and then, to crown all, I have had to sit and listen through these two sessions and then at another meet-

ing, to all about great Babylon, what someone else has built. I have no patience with all this talking about the fact that cows in Connaught have long horns; unless you've been to Connaught you don't know whether they have or not. Now, this talk about the roads on the other side is not borne out in point of fact by all the conditions that surround the question. I have been across the continent, I have been in twenty-two States and I have been abroad and I want to tell you that American engineers have nothing to learn, either in regard to new construction or care and maintenance of roads. The chief difference between the two countries is simply this: we are building new roads and they are keeping in repair the roads they have already constructed. I have been over many miles of roads in New England and other parts of the country and found them in just as fine a condition, in some instances a finer condition, than those I saw abroad. So that I get out of patience when people are continually harping about those things that they know practically nothing about. Within fifteen miles of Paris, it is with difficulty that you can sit in your automobile. The great trouble with our people is that we are prone to take the suggestions about things that someone else has seen as law and gospel and compare before investigating conditions. I venture to say that had things been reversed and the people in the old world been transferred to where we are on this continent, they would not make the showing that we do here in this great and glorious country of ours.

It is not so many years ago—and, Mr. Chairman, you will pardon this little digression, because I can't help it, that's the Scotch in me—since the little *Mayflower* landed on our shores and had her sides washed by the waters of Plymouth Bay—not three hundred years ago—and what did they find? An unbroken wilderness, rocks and hills and the habitation of no man, and in that short period of time we have taken that wilderness and made it to blossom as the rose and to become the granary of the world. We have made those old rocks and hills to give us greater treasures than was ever possessed by the Queen of Sheba. What we have done along other lines that go to make a successful and progressive country, we will do in regard to this good roads matter. We have just taken it up, that's all.

I am at a loss at this late hour and with the length of the session in extending this last remark. When Brother Terry was talking about the whale story, I was thinking of the old lady who was quite a crank on interior decorations and carried it to excess, and one day became a little faint. She reached into the cupboard to get a little wine to rejuvenate her and by mistake she got a bottle of red ink and never discovered her error until she had gotten outside of the red ink. Immediately they sent for the doctor, but when the doctor came and relieved her by removing the cause of her illness, being a dry joker, he remarked, "Madam, this interior decoration has gone too far." Now, I come from the little State of Connecticut

and my subject matter suggests that I be a little careful how far I go with my little talk here today.

Ten years ago I was in this little zone that this meeting is held in—the sun parlor of the Wayne Hotel. There the American Road Builders' Association was practically given birth. From that Road Builders' Association, the nucleus of which was five men, interested in the wheel, it was the bicycle at that time, have grown many associations, and I have attended the meetings and deliberations of nearly all of them, but I have never attended a meeting where the interest was greater and where the intelligence in regard to that which is necessary to be done was more manifest than at this meeting. Nor have I ever been able to see in all of the deliberations of these conventions, gentlemen like yourselves who have sat through several hours, with deep interest to learn still more what there is to be learned.

I come from the little State where they say that Washington and Lafayette sojourned for a short time when we needed their assistance. In my travels through the State, which embraced every town in it, I have been pointed out numerous rooms that George Washington slept in and I have had indicated to me many trees that Lafayette sat under and ate his dinner, and after having had so many rooms pointed out that Washington slept in and also so many trees under which Lafayette ate his dinner, until I come to the reasonable conclusion, that George Washington and General Lafayette must have spent all of their time sleeping and eating, and I wonder how they had any time to do any fighting.

The little State that I represent commenced with small beginnings. An annual State appropriation of \$75,000 was all that we had. To give you an idea of how the interest has grown, just before I resigned my office by the will of the governor, owing to the fact that I had made a mistake in the caption of my ticket, which mistake I believe I should repeat if I had to do it over again, I let a contract for \$400,000, the largest contract ever let to any contractor in one contract in this country. The State of Connecticut is very far from being a wealthy State, and when the last speaker was enumerating the States, there rose in my heart a feeling of great joy and pride to think that I had been able to serve my people in that community for nearly eighteen consecutive years. I am very glad to know that the people of my State occupy such a proud place as they do. For twelve long years there never was enough money placed in the hands of the highway commissioner to do one mile of even a water bound macadam in any one town. It was the duty of the commissioner and he gladly accepted the privilege of going out amongst his people and getting acquainted with them. I can remember very well one year of having only \$500 to spend in each one of thirty-two little towns and making a survey with a lock level, and sitting down on the side of the road, computing the yardage, and letting the contract direct to the officials of the

town. I also remember that this small beginning in these thirty-two towns resulted in the little towns themselves asking for an appropriation of \$9000 at the next opportunity. It is a delightful narrative for me to relate.

Not all of you gentlemen here of the forty-one States represented, come from the great States of New York or Pennsylvania or the States with a large levy to draw from. There are many States that have as yet hardly entered upon or made a beginning in State aid, and perhaps from some of the little things that I may relate in regard to my State, there may be some thought suggested that you may take away with you by way of encouragement, and if there is anything I hope you will feel perfectly free to appropriate it and I shall be very glad to have you do so.

State-aid for highway improvement came up through introduction of the State Board Trade. After the passage of the law the little towns of the State had access given them to participate, not in accordance with their mileage of roads, not in accordance with their area, but in accordance with their grand levy,—the wealth of the town—as the unit of measure. Almost from the commencement of State-aid our towns began to appreciate the fact that their roads were not entirely local but general in their use and a public possession and therefore should be paid from the public purse. We saw right away that a wise move had been made on the part of the State in coming in to assist these little towns in the construction of these roads that were to be used more generally than heretofore, for an improved highway always invites travel. Therefore the appropriation was made on the basis of the grand levy which is the total valuation of the town. The towns came in and accepted it. We have been in the road movement some nine consecutive sessions, our sessions being held biennially. As Brother Terry says, you may amend your national law without limit; we amended our road law nine consecutive times and I presume they will continue to amend the law every two years to meet new conditions while it remains on the statute books of the State. All the grand levy of the entire State does not suggest that we took up any extravagant form of construction; only \$9,000,000 with a million people, with a total area of 5004 square miles and 15,000 miles of roads, the largest mileage of roads of any State in the Union, per area.

Today the department has \$6,500,000 to expend in that little State, \$3,000,000 of this amount covers an unexpended balance I turned over to my successor, when I resigned my office as highway commissioner and a new appropriation of \$3,500,000 for the use of the present commissioner. I don't make the remark with conceit, but I do make the statement as something worthy of emulation that that is the largest amount of money being expended by any State in the Union on the basis of population, \$6.50 per capita. Now, how was that brought about? By considering the condition by which

each town in the State was surrounded and not importing one dollar's worth of material if the material to be found in that town would take care of the road question and build a road that would be competent to sustain the travel that the road had to bear, and that is the best definition I know of for a good road. If it was a graded road it was put down as a sub-soil job. If it was a gravel road it was laid in courses with a good foundation. If it was a macadam road, the material was carefully selected, not only in reference to its quality, but also in regard to the method of construction employed and the dimensions of the stone used. If it was a question of drainage, all the necessary drainage was put in. The proposition is simple, get the water out of the road, off from the road and away from it—out, off and away. A well built house must have a tight roof and a dry cellar, so with a road, it must have a water proof top and a good foundation. That's the whole science of drainage in my judgment.

A system of fourteen trunk lines was early laid out through the State, that drained a population of 852,000 of a total population of a million people, and went in and out of 132 towns out of a total of 168 towns. No one knows better than Brother Terry, who has been right in the forefront of this great movement, who has fought many obstacles successfully and always with great courage, that the strongest argument that has been raised against national aid for our highways is the one that he used when he says, "Every man wants to have that road built in front of his own house," and the nearer you get to that the nearer you will get to having a unanimous vote. But some people fail to appreciate this fact that most of the money used in this country in the past for the improvement of our highway system in any State has always been where the most voters reside, and the isolated farmer—the man on the outskirts of the borough or town—who has been paying his taxes year in and year out uncomplainingly, got scant treatment. It remained for State-aid to come in and make these connected roads, and in giving to the isolated farmer access to a splendid road as some return for the taxes he has been paying. You are assisting the town every time you build a trunk line system, because the town's money, formerly spent on these roads where the most people reside and which are generally the trunk line roads, can be used on roads not trunk lines. Thus the entire movement both from a State and Federal standpoint will be benefited by an intelligent system of trunk lines.

Now we come down to another question that you have not met here. On the other side I traveled for days and did not begin to see the number of automobiles that I find with us in the East. Why, during a whole day's travel outside of the environs of the large places I rarely ever met an automobile. Sixty-five per cent of the travel on our roads are the automobile and 35 per cent the horse drawn vehicles. Now, that question of traffic is never alluded to very much here. They regulate their traffic and protect it; they also

build the wheel scientifically. Where have you ever seen a wheel here whose diameter was 7 feet, with a tire 8 inches in width, in this country and in common use, and where the horses are hitched tandem and where everything that way is done scientifically? It is as much as a man's political or official life is worth today to force this question of wide or narrow tires here in our country. In my State we have placed on the statute books a wide tire law but its application has been extended from year to year thus giving the farmer a chance when he purchases a new wagon to be within the law. It is needless to say that such a law is a farce and the old wagon is patched up and no new wagon purchased. You have got to have all those things done and it means time, money and patience. Another thing that we have had to contend with is the splendid development of the automobile. It has been a development. No commissioner ever anticipated what would be required of him in the rapid development of automobile traffic. I delivered an address in Boston ten or twelve years ago and the topic was, "The Country Road and the City Street," and I know that I never alluded, even in passing, to the question of the automobile. I devoted the whole of my thought to the destructive force on those roads of the hoof and the wheel, and how the mechanic and how the chemist was busy and busy as they could be, to see whereby he could shoe that horse and that wheel to destroy the road. I stood a short time ago on the roof of one of the largest buildings in Hartford looking down on our main highway, and the street was full of automobiles. It is only a few years ago when I looked over the record, 225,000 automobiles, I thought that was a goodly number, but what do I find now? That is all changed. It's a million five hundred and some odd thousand, that's the record of automobiles, not to say anything about the motor trucks. You don't hear very much about the destructive force of the motor truck. We commissioners, who are a little unfortunate in not having the contractor live up to the specifications, are inclined sometimes, I am a little afraid, to lay the blame on the automobile. But I do not hesitate to say that a large part of the trouble is faulty construction.

Now we have a new element coming in, we have motor trucks and traction engines. Now we have to begin and reconstruct and on these great through lines we have to provide a construction to combat this tremendous traffic. No man was more devoted to the water-bound macadam road than the speaker, and I am still of the same mind, by reason of the fact that I have utilized the old macadam roads by putting on a bituminous surface over the old macadam roads that have been down many of them for seventeen or eighteen years, thus restoring them to a smooth water-proof surface. Because you know if you get a good, smooth surface you are not going to offer any resistance, and when you don't offer any resistance you remove friction and when friction is removed

you minimize wear. I am not going to say what particular plan I adopted, by reason of the fact that I read a story once that is very appropriate here, in which a gentleman visited with an old son of Erin where he saw a deal board set up on two bricks and in the center of the deal board was half a brick and a faded flower and the gentleman's curiosity was aroused, and he asked, "What is it that you have got there, what is that for?" "Well," he says, "that is what sent me to the hospital and I remained there for three months and the faded flower on the brick is the flower from the grave of the man that threw it." So that I am not going to say anything about what particular material was used in the assembling of the stone, because that would be very unfair, but come over into our State and investigate for yourselves. But the evolution of our work has been to educate the people to do that which our intelligence and experience suggests is right and to spend their money economically and honestly and see that the work is done well, and also that the upkeep of that road is sufficient to keep it in good condition for three hundred and sixty-five days in the year.

I had intended to extend my talk but the hour is late so I shall close. I thank you, gentlemen.

THE CHAIRMAN: It is my pleasure to introduce as our next speaker, the Hon. Frank W. Buffum, State highway commissioner of Missouri, who will give us a talk on "The Missouri Plan."

THE MISSOURI PLAN

BY HON. FRANK W. BUFFUM

State Highway Commissioner of Missouri

When I was called here to speak, they failed to state what my subject would be. I telegraphed and asked what it would be, because a Missourian is liable to speak on 16 to 1 if he isn't notified—that is, sixteen miles of good roads to one of bad. But when I came here this morning I hunted around and found a program and found that my subject was to be, "The Missouri Plan," or system or something of that kind, and so, without preparing any speech for your special benefit, I will give you, as far as possible, the plans and methods and what the highway department of Missouri has been trying to do in the last year, or portion of the year. Missouri has had some counties with some very fine roads, and a very large number of counties with a very large mileage of very poor roads. It has been brought about, not so much by the desire of the people not to have good roads, as the fact that our laws were very deficient as to the spending of the money, the raising of taxes, and the otherwise handling of the funds of the State. My predecessor, Mr. Curtis Hill, a very fine gentleman, started in under the board of agriculture. At the end of his term, Governor Major, feeling that

the highway department should be a department of its own, had a bill put through the legislature, establishing the highway department, of which I had the honor to be the first Highway Commissioner in the State. It was not my pleasure to become the highway commissioner of this State, but one morning I found a letter on my desk, asking me if I would take the place. My business interests were such that I delayed two days before I answered it, but at last, at the solicitation of some of my local friends, I took the place and am trying to do the best I can to upbuild the State of Missouri. Our governor is one of the greatest road enthusiasts in the United States. He is the one who organized the two Good Road Days in the State, which have gone all over the United States, and the correspondence that comes to my office, asking for some information in regard to this, would surprise anyone. The results we have obtained from the work of those two days surprised us. At first it was taken to be a joke by some portions of the State, but when we got through and when we had shown that with proper organization of our department, with the assistance of the governor, and with the assistance of the press, we got out in our State, it is estimated, in the neighborhood of 200,000 people working on the roads of the State, it is estimated that we spent \$300,000 on those roads either in labor or subscriptions on those days, and if that is the case, we certainly have spent \$1,000,000 since, because they are going right ahead with this work; they never stopped after the two days was over; they saw what they could do, and we are getting results from those two days; they will be made Good Road Days legal days by law at the next session of the legislature, and I hope, in courtesy to our governor, that the different States will make the same two days throughout the United States Good Road Days, because you will get results that will certainly repay you a hundredfold for your trouble. In regard to the road law of the State of Missouri, I would say this to you, that we have what is known as the local district, generally known as the 8 mile district, being generally 8 miles square, but not necessarily so, and included in this district must be an incorporated city or town and this plan is carried on to a great extent around the larger cities, and, in fact, around some of the smaller towns. It works with very good results, and also, they can raise bonds in that district, if they desire. A very large number of them don't raise bonds; I have warned them to be careful of the bond issue, reading as I do, in many papers, of the troubles that come later in other States, or, if they raise their bonds and get their money, to be sure it is not wasted by being spent all at once through some enthusiast who comes in, gets the money, spends it possibly honestly but injudiciously and is off again, and you have nothing to show in return in the way of results or for the future maintenance of your roads or replenishing of your road system; but the bonds have to be paid.

But the greatest law ever put on the statute books of any State is what is known as our county seat to county seat drag law. The law itself does not show anything very great in it; it simply gives \$15 a mile a year for the dragging of roads between county seats over routes to be selected by county commissions and approved by State highway commissioner. That is not where the good results come in from the law, however. It brought a very large number of miles into our road system, in the neighborhood of 12,000 miles or equivalent to about one-half the way round the earth, if I remember my geography right. That being the case, we have an immense amount of mileage. Now, when I took this office, I made up my mind that if I was going to have roads I was going to have them and there wasn't going to be any half-way business or foolishness about it. I was going to try to run it like you run a business, get my overhead expenses down, find out where the leaks were, find out where we didn't have good roads and why we shouldn't have them. I have been in this road game about fifteen or twenty years and I found out that we spend the great bulk of our money putting wooden tops on bridges and have nothing left to fix our roads with; consequently, I insisted on concrete or other permanent culverts being built in our State, and before any one of these 774 roads were established, nearly 7 to each county, I established a system of rules which they must comply with before I would declare it to be a county seat road, because there happened to be a clause in the bottom of that law that said they couldn't have a road until it was approved by myself; and this is what I put in the form:—That all roads should be at least 40 feet wide; that they should be 30 feet graded, that they should be graded at least 2 feet high in the center, if it became necessary; I didn't think they'd get up that high, but if they did it wouldn't make any difference, because a dirt road will get down anyway; that the culverts should be not less than 30 feet and should be all installed at once, and bridges installed as rapidly as possible and with concrete tops; that all hedges should be cut to 5 feet on the highways, so that the roads would get plenty of light and dry out in the spring; that all hedges should be cut and pulled 150 feet from the corners to eliminate the dangers of automobiles passing around the same; that where there was a gravel pit within 2 miles of any road, they would agree, before the first day of July, 1914, to either rock or gravel that road; that all hills should be reduced to at least 7 per cent grade. Now, we are getting those results. I did not think we would, but when I found that about 30 per cent of the counties had gone to work and had done that much then fully 30 per cent more did so when they found it was necessary and I insisted that the balance of them should do it, because I said, whatever the others have done, you must do, you must do it or not get your road. Then sprung up a rivalry immediately. When a county would back out and say, "We won't build that kind of a road," I said, "It's with you; you will be given thirty days and if,

within thirty days, I come back and your road is not fixed, I will locate a road in another part of your county;" and they at once got busy and I don't remember even a single county that has thrown up the privilege to get a highway from "county seat to county seat," because I tell them that possibly in the next legislature more will be given to the counties that have taken care of their roads. We have across our State some trails and we are trying to build them up as fast as possible. We are urging that they be made complete, that they be pushed at once and finished, and when a trail does not get up and get a move on itself, I do the same thing I do with the county seat road, start another trail, and don't you ever forget, they get busy right quick on the other one that had it established, because, if you establish a trail and have them understand that they have it, they will simply go into the house and into a Rip Van Winkle sleep. We are trying to get five or six trails across the State of Missouri east and west and the same north and south and are pushing them to a finish. We hope for federal aid on this trail work and also on some other work through the State, but I am not a believer in establishing through routes across the State by Federal aid entirely. I believe it will come and be endorsed by the congressmen of our State very quickly, as soon as we can take care of our local roads that lead into these roads; in fact, it will get to a point of not merely wanting it; they will insist that we have Federal aid for our through highways and federal aid will come and be welcome. We are doing road work on one basis, "Do it now; don't put it off." I aim to ride every road between the county seats. I keep four automobiles in service in the State of Missouri and I go from one to another and get around from county seat to county seat and hold meetings with our commissioners. If the roads suit me, I approve them, and if they don't, we sit down and argue the matter out. They must go the right way, not be built for the building up of some town or for the killing of another, and not be done with malice or prejudice, but be done for the good of the State. We are getting these results, getting them promptly, straight from the shoulder. We are not fooling away our time, but we are working every day. The *St. Louis Republic* started the good roads fund in our State and raised for me the sum of nearly \$4000 for machinery. I am ordering the machinery now, sending it to different portions of the State, cutting down the hills in one place, grading in another, and scattering that work over the State in such a way as to bring to our State a good roads system. A road is like a chain; a chain is no better than its weakest link, and a road is no better than a bad piece in it. If you have a bad piece in the road, a man can ride 150 miles and strike that bad piece and never forget it, and we are trying to get the bad pieces out and get the roads handled in a systematic manner. We are trying to have the money spent in the right way and we are bringing men and carrying them around, showing them the latest improved machinery. I brought two men with me here at the State's expense,

men who will have charge of two of the outfits, and as soon as I get through with them I will take other men to other conventions and let them see machinery, see the latest and most improved methods of building roads, and thereby we hope to get up a system of road building in the State of Missouri that will not be equaled in the United States. I thank you.

A MEMBER: I would like to ask the gentleman what he builds his roads out of in Missouri?

MR. BUFFUM: In Pike County, we build our roads from gravel entirely or almost entirely; in other counties, we build them of crushed rock; in other places, of crushed rock with a top dressing of gravel. One of the finest roads in the State is between Hannibal and Palmyra; it has been given a calcium carbide treatment and they have been very successful. A very large number of our roads are dirt roads, but we have from the railroads a tariff of one-half a cent per ton per mile that practically puts crushed rock at the door of any community that wishes to take advantage of that tariff. That does not give the railroads much profit, but the railroads are interested in the road work and are willing to give us that rate, and we are bringing that rock to the prairies where they have no rock, and establishing rock roads in that way. We have fifty counties that have plenty of rock, and we have fifty more that have scarcely any rock exposure in them at all, but I have found out that many counties that thought they had no rock, by going around, could find an exposure of a small place, and if I can find a foot of rock in a county I'll find the balance of the quarry.

THE CHAIRMAN: President Page, in pursuance of the custom of these conventions, has appointed a committee on resolutions. The personnel of that committee will be announced by the secretary, Mr. Pennybacker.

Committee on Resolutions

Chairman, GEO. C. DIEHL

Representative at Large, James H. MacDonald, Former State Highway Commissioner of Connecticut.

Alabama.....	W. S. Keller, State Highway Engineer
Arkansas.....	Judge Joe Asher
Arizona.....	Judge T. G. Norris
California.....	A. B. Fletcher, State Highway Engineer
Colorado.....	A. J. Lawton, Commissioner Public Works, Colo. Springs
Connecticut.....	R. L. Saunders, Deputy State Highway Commissioner
District of Columbia..	Charles P. Light, Field Secretary, Amer. Highway Ass'n.
Delaware.....	John Bancroft
Florida.....	
Georgia.....	Prof. C. M. Strahan, Dean of Engineering, U. of Ga.
Idaho.....	

Illinois.....	A. N. Johnson, State Highway Engineer
Indiana.....	C. S. Kenyon, Indianapolis
Iowa.....	Prof. T. M. MacDonald, State Highway Engineer
Kansas.....	W. S. Gearhart, State Highway Engineer
Kentucky.....	Robert C. Terrell, State Engineer
Louisiana.....	W. E. Atkinson, State Highway Engineer
Maine.....	Lyman K. Nelson, Chmn. State Highway Commission
Maryland.....	R. Keith Compton, Chmn. Paving Commission, Baltimore
Massachusetts.....	Lewis R. Speare, Former President A.A.A.
Michigan.....	P. T. Colgrove, President Michigan State Good Rds. Assn.
Minnesota.....	Geo. W. Cooley, State Highway Engineer
Mississippi.....	
Missouri.....	Major Frank W. Buffum, State Highway Commissioner
Montana.....	Wm. Jordan, Jr., City Engineer, Helena
Nebraska.....	G. E. Parisoe, Secy. Omaha-Lincoln-Denver Assn.
Nevada.....	
New Hampshire.....	S. Percy Hooker, State Superintendent of Highways
New Jersey.....	A. G. Batchelder, Chairman Ex. Comm. A.A.A.
New Mexico.....	Francis E. Lester, Pres. State Assn. Highway Officials
New York.....	Geo. C. Diehl, Chmn. Good Roads Board, A.A.A.
North Carolina.....	Dr. Joseph Hyde Pratt, State Geologist
North Dakota.....	
Ohio.....	L. M. Brown
Oklahoma.....	Col. Sidney Suggs, State Highway Commissioner
Oregon.....	J. R. Penland, Albany
Pennsylvania.....	John A. Wilson
Rhode Island.....	John A. Richmond, Member State Board of Pub. Roads
South Carolina.....	W. P. Cantwell, County Supervisor, Charleston
South Dakota.....	
Tennessee.....	Dr. J. D. Henderson, Knoxville
Texas.....	Judge Albert S. Eylar, El Paso
Utah.....	
Vermont.....	J. W. Votey, Dean of Engineering, Univ. of Vermont
Virginia.....	Capt. P. St. J. Wilson, State Highway Commissioner
Washington.....	M. Roy Thompson, County Engineer, Tacoma
West Virginia.....	Geo. B. Chorpeneing, Member State Roads Commission
Wisconsin.....	A. R. Hirst, State Highway Engineer
Wyoming.....	A. J. Parshall, State Engineer
Canada.....	The Honorable A. W. Campbell, Deputy Minister of Railways and Canals, Ottawa, Canada

FEDERAL LEGISLATION SESSION

September 30, 10 a.m.

UNDER AUSPICES OF AMERICAN AUTOMOBILE ASSOCIATION

Mr. Diehl in the Chair.

THE CHAIRMAN: The A. A. A., under whose auspices this meeting is held today, is an earnest advocate of road building. It is believed that we will never have connected and properly developed system of highways until the cities of the country pay a fair share toward the cost of construction. For a hundred years good roads were a local issue and the entire cost of the construction was borne by the locality. A century has demonstrated that this system does not result, except in isolated cases, in good roads. In sections where there are large cities, County aid laws frequently accomplish an equitable division of the expense between the city and the country, but where there are no large cities the unit must be extended and a State law is necessary to secure a proper division of the expense. There are many states which are so relatively low in taxable assets that the unit must be still further extended and the Federal Government, through legislation, must be called upon to divide the expense of road construction in these states between the rural localities and large cities of the country.

Three distinct methods have been suggested for federal participation in road building and it is with a view of having a full and fair discussion that we have asked the advocates of each of those plans to be here today. The first plan seeks to distribute the government money throughout all the townships of the United States, so that every mile of the 2,000,000 miles of highway may receive some small portion of it. The second plan seeks to build main highways in coöperation with the State, with the initiative with the State, and with the approval of the Federal authorities. The third system seeks to have the government build a so-called federal system of trunk lines, connecting the various capitals, and running from ocean to ocean and from the lakes to the gulf.

The foremost advocate of distribution among townships is with us today. He has been in Congress a good many years and is probably one of the most aggressive road enthusiasts in Congress, and while some of us, myself included, do not agree with his plan, we recognize his ability and aggressiveness. We are glad to have him here, and, like him, we are from Missouri and want to be shown. It is a pleasure to present Hon. Dorsey W. Shackelford, chairman of the committee on public roads of the House of Representatives, which we hope will be the most important committee of Congress.

FEDERAL ROAD LEGISLATION

BY HON. DORSEY W. SHACKLEFORD

Chairman of House of Representatives Committee on Roads

I esteem it a distinguished honor to have been invited to address this great road congress. The deliberations of this body, if wise, must advance the civilization and promote the happiness of this already highly civilized and happy land.

Nothing is more essential to the prosperity, the intelligence, and the happiness of the people than easy and convenient ways of travel and transportation. The degree of a country's civilization may, in a measure, be gauged by its highways.

The term highway is not to be limited to mere roads but must be held to embrace oceans, rivers, canals, railways, and every other means over which people or property may be carried.

No country has a more extensive and adequate system of highways than the States of this Union. With their vast coast line, indented by multitudinous harbors; their canals; their innumerable rivers, with unbounded possibilities for navigation; their millions of miles of well-constructed and efficiently maintained railways; their more than 2,000,000 miles of roads of varying degrees of perfection, the American people may well be proud of their possessions and their achievements in the matter of highways.

The subject upon which I am expected to talk today is, "Federal Road Legislation."

Whatever doubts may have formerly existed, it is now generally conceded that the federal government has authority to construct and maintain roads which are used for federal purposes. This granted, it follows that it also has authority to aid the States in the construction and maintenance of roads which are in part devoted to federal use.

There are at least three sources from which Congress gets power to legislate in relation to roads: First, to provide military roads; second, to provide post roads; third, to provide roads over which interstate commerce may be carried.

To what extent these constitutional powers should be exercised is a question which will severely tax statesmanship to answer.

Primarily it is the duty of the States to provide their inhabitants with roads, and it would be a long step backward if congressional legislation should afford them any means for avoiding this fundamental obligation. On the other hand, to provide an adequate system of roads lays a heavy burden upon the taxpayers of a State, and it is no more than justice that the federal government should contribute to the upkeep of the roads of the State which it uses in the performance of federal functions.

It can not be doubted that an overwhelming majority of the people want federal road legislation; but, unfortunately, they

radically differ in opinion as to what such legislation should provide. They are divided into two general classes, which for the purposes of this discussion may be designated as the "touring-roads" class and the "business-roads" class. The "touring-roads" class is marching under a banner upon which is inscribed in letters of gold: "See America first." The "business-roads" class is marshaling its forces under a flag which bears the legend: "Cheaper transportation and lower cost of living."

The "touring-roads" class is largely made up of rich automobile owners, who desire to spend a part of their leisure in touring the country. These are reinforced by manufacturers of road machinery and road materials, who regard Uncle Sam as "good pay," a liberal buyer, and one who would be a valuable customer if only he would embark in the business of building "national roads."

The "touring-roads" class demands that the United States shall limit its road activities to the construction and maintenance of a few "ocean-to-ocean" and "across-country" highways of great perfection and then leave the rest of the people to build their own roads or do without, as they may choose.

The "business-roads" class believes that in dealing with roads we must keep in mind their functions and the relation which they bear to the general transportation system of the country; that, as the harbor is the terminus of the river and the railroad, so, for practical purposes, the railway station is the terminus for roads; that neither freight nor passengers will ever be carried long distances over roads as cheaply as they could be over railways, and that it is an idle dream to imagine that auto trucks and automobiles will take the place of railways in the long-distance movement of freight or passengers; that the proper function of roads is not to connect antipodal oceans nor the distant capitals of far-away States, but to make easy communication between the farms on one hand and the towns and railways stations on the other, to the end that the farmer may market his crops at less expense and the town dweller may get farm products more easily and at less cost. They therefore favor a general system of roads radiating from the towns and railway stations out among the farms.

I am quite convinced that a large majority of the people belong to the "business-roads" class, but they are not here today. They are at home sowing wheat for a harvest from which all of us must get our bread. They have neither the time nor the money to travel across the continent to attend road congresses. Nevertheless, Mr. President, they are the plain people—the producing masses—upon whom we must all depend.

Mr. President, I have been accused of being antagonistic to automobiles and automobile interests. It is not true. I am an automobilist myself and a member of an automobile club. I believe that no economic instrumentality has contributed more to the progress of our times than has the automobile industry.

I do not want to see the number of automobiles in use diminish, but rapidly increase. I want to see the whole country supplied with a general system of average good roads and every farmer replace his horse and buggy with an automobile. I want the time to speedily come—and come it will—when the products of the farm are hauled to the towns and the railway stations in auto-trucks, when the fields are plowed, the crops cultivated and harvested, by self-propelled tractors. If I shall live my allotted time, I will see all of this. Even now the time has already come when the automobile is no longer regarded as a mere toy of the idle rich, but as the utility vehicle of the plain, everyday business man. It also affords me pleasure to know that there are now more autos in the country than in the large cities.

The “touring roads” advocates have two plans, by one of which they hope to secure some high-class “See America first” boulevards.

Their favorite plan is to have the United States, independently of the States, build and maintain a system of “national roads.” If they shall not be able to get these “national roads,” then their next plan is to have the federal government and the States jointly construct and maintain a limited mileage of excellent “across country” roads.

Under both plans the primary purpose is to get “touring roads.” To accomplish this they feel that they must, as far as possible, get away from local influence and local control.

The “national roads” movement has had most of its momentum imparted to it by the American Automobile Association and the National Highways Association. The first of these is an association formed to promote the pleasure of its members, to whom “touring roads” are a necessity.

The leading spirits in the other—the National Highways Association—are gentlemen who are, or have been, connected with the manufacture of road machinery and road materials. Both of these associations are dominated by men of the highest character and ability. They have abundant leisure and unlimited resources. They have devoted much time and money to their propaganda. Every year they collect and expend many thousands of dollars to cultivate sentiment for “touring roads.” They have found the fountains of publicity. Wherever a road convention or a road congress has been held they have been in it with delegates enough to dominate it—to fashion and form its resolutions. They have even been powerful enough to place before the country in an unfavorable light those who have opposed their plans. Yet, Mr. President, at the hazard of being called a “knight of the dirt roads,” or a “pork-barrel Congressman,” I will avail myself of this opportunity to reason with these “touring roads” advocates—to convince them that the first duty of Congress on this, as on every other subject, is to legislate in a practical way, in the interests of the general masses of the people.

Let us examine the "national roads" scheme.

There are in this country about 2,250,000 miles of roads. Every mile of these roads is a prime necessity to the people who live along it.

Mr. Charles Henry Davis, president of the National Highways Association, estimates that it would cost \$20,000 a mile to build "national roads." At that figure our entire road system of 2,250,000 miles would cost \$45,000,000,000. The human mind is paralyzed in contemplation of such an enormous sum. All the nations of the world could scarcely raise it.

To escape from such a situation the American Automobile Association and the National Highways Association propose that only a limited number of miles of "national roads" shall be built. Fifty thousand miles is the limit they suggest. This would leave 2,200,000 miles of roads unprovided for; and yet the people along these 2,200,000 miles of unprovided-for roads would be taxed to give these 50,000 miles of fancy "national roads" to favored communities and favored classes.

I hold in my hand a map of the United States showing the tentative location of these proposed 50,000 miles of "national roads." I can not take the time to analyze it as to all of the States. One or two will illustrate the whole scheme. Look at Ohio, for instance. One "national road" is laid along its northern boundary, through the counties of Ashtabula, Lake, Cuyahoga, Erie, Ottawa, and Lucas—7 counties. The other is laid across the center of the State through the counties of Belmont, Guernsey, Muskingum, Licking, Franklin, Madison, Clark, Montgomery, and Preble—9 counties. All told, these "national roads" in Ohio would touch only 16 counties and leave wholly untouched 72 counties. Yet to give "national roads" to these favored 16 counties the other 72 untouched counties would be taxed. The entire mileage of these two "national roads" through Ohio would not be much more than the mileage of improved roads which Hardin and Auglaize Counties have already built for themselves; but the enterprising people of these two counties would be taxed to build these "touring roads," over which the rank and file of them would never travel or haul a bushel of wheat in a lifetime.

Let us take another State, Alabama. This "national roads" map lays one of these "touring roads" through the counties of Dekalb, Etowah, St. Clair, Jefferson, Tuscaloosa, Green, and Sumpter—7 counties. Another passes through Cleburne, Calhoun, Bibb, Marengo, Clarke, Washington, and Mobile—8 counties. In the whole State of Alabama 15 counties are touched by these expensive highways and 52 counties are left wholly untouched. Yet these 52 untouched counties must be taxed to build luxurious roads through these favored 15 counties. After these untouched counties have paid this tax they may then build themselves some roads if they have any money left. These proposed high-class "national roads" through Alabama would not aggregate more than

400 or 500 miles. Montgomery County alone has built more than that many miles of improved roads. Yet her wide-awake people would be called upon to help pay for these "joy rider" roads, which would be too far away to ever be used by them.

Let us look at these 50,000 miles of proposed "national roads" from another angle. I recently read a paper by Mr. Charles Henry Davis, president of the National Roads Association, in which I find this statement: "Fifty thousand miles of national roads at \$20,000 a mile would cost a billion dollars."

Now, the federal government will not likely expend more than \$25,000,000 a year on roads. At that rate it would require 40 years to complete the proposed 50,000 miles. Long before that time shall have elapsed most of us will have died and gone to judgment. What we want is roads while we live.

But Mr. Davis proposes that having once adopted the policy the Government would proceed to build one road at a time. In that event some States would be reached the first year and others not until the end of forty years. Which would be the first lucky State? which the last unlucky one?

Mr. President and Gentlemen, don't you see that this "national-roads" scheme is a dismal delusion?

Now, just a word or two in relation to the other scheme for getting "touring roads"—that of having the federal government and the States jointly construct a limited mileage of high-class "across-country" highways.

The most concrete presentation I have seen of this plan is a bill now pending in Congress. I have not the time to analyze it in detail now. I shall content myself with calling attention to its two most salient features. As I said a moment ago, the "touring-roads" class desire to get as far as possible away from local control. To accomplish this the bill to which I refer provides that a new office shall be created—that of public-highway commissioner—who shall keep his office at Washington, where he may not be influenced nor even impressed by the yearnings of the people among whom the roads should radiate. Then, "to make assurance double sure," the bill carries this further provision: "*Provided, That all questions as to the location, method of construction, and maintenance shall be finally determined by the commissioner of public highways.*"

If such a provision as that shall ever be written into the Federal law, then, indeed, will the "joy rider" reign supreme.

Mr. President, it is not a road, nor yet a few roads that we want. What we must have is a general system of good roads extending throughout the length and breadth of the land.

I hold in my hand a pamphlet issued by the National Roads Association.

On one page of this pamphlet is a picture of a rocky, muddy, impassable road. Beneath the picture in bold type is printed the words: "Poor roads—poor schools—ignorance—poverty."

On the same page is another picture—a picture of a good road under which, in equally bold type, is printed the words: “Good roads—good schools—knowledge—prosperity.”

That is a pertinent illustration. According to this pamphlet, where good roads are there will be good schools, knowledge, and prosperity, while along bad roads poor schools, ignorance, and poverty will prevail. Yet this pamphlet advocates devoting 40 years to improve 2 per cent of the roads, leaving the people along the other 98 per cent groping in ignorance and poverty. Even worse than that, the National Roads Association proposes that the people along the 98 per cent of the roads who are thus to be left forty years wandering in the wilderness of poor roads, must help pay the costs of the 2 per cent of the roads which the American Automobile Association and the National Roads Association would build to the end that the rich automobile owners may “see America first.”

Abraham Lincoln once said, “This country can not exist half slave and half free.” Paraphrasing that lofty utterance I say this country can not exist 2 per cent enlightened and 98 per cent ignorant—2 per cent good roads and 98 per cent bad.

Mr. President, another fundamental error into which aristocratic classes fall is that there is no official wisdom and capacity except in federal officers. Why may not a State officer possess wisdom, capacity, and devotion to duty to the same extent as a federal functionary? Suppose you should create the office of public highway commissioner as asked for by the “touring roads” advocates. Where will you get a man to fill the office? Will Jupiter detail Mercury to bring us one from the ethereal realms above? No. You will have to take some citizen from some State, educated and trained in some State college. Can not the States get the same kind of men? Indeed, have not many of them already provided themselves with the best talent in the land?

Oh, you say the States have been slow to grapple with the road problem. Sir, how much slower have the States been in this respect than has been the federal government?

The States have not been slow in dealing with roads. On the contrary, they have made great progress, considering the difficulties they have had to meet.

“Touring roads” gentlemen beam with enthusiasm as they tell us of the good roads of France over which they have traveled. Why do not they go to the trouble to inform themselves of the fact that there are more miles of good roads in this country than there are in France. Every mile of these roads has been built by the States without either financial or engineering assistance from the federal government.

Before the “touring roads” advocates berate the States for being tardy in road building let them consider the surrounding facts.

The rapid changes which have taken place in the character of road vehicles and the method of their propulsion has thrown even the engineering world into confusion as to what should be the character

of road construction to meet the demands of traffic. Roads which were sufficient for the uses to which they were put a decade ago are wholly inadequate for the traffic of the present day.

Again, most of the States are hampered by archaic constitutions which prevent them from levying as much road tax as their people would cheerfully pay. It takes time to amend constitutions. However, they are doing it with much celerity.

Until recently few of the States had provided themselves with adequate highway departments. In another year or two very few will be without them. Already some of the best administrative and engineering talent of the country has been secured by State highway departments.

Road construction and road maintenance involves many mechanical and financial difficulties. Differences of climate, kinds of road material at hand, volume of traffic, and available road funds will require much variety in road construction and upkeep. These are problems for the States and their civil sub-divisions. Roads are local affairs, and their control should remain with the States and the people in whose midst they are. The federal government should not invade this domain. Any federal legislation which should in the slightest degree tend to belittle or discount States or State highway departments would be reactionary in the extreme.

Where the States construct and maintain roads of such degree of perfection as to supply the federal government with highways over which to perform its functions with reasonable facility, then it should contribute to their upkeep.

Of course, the federal government should see to it that it is not overreached in these expenditures. Congress should provide general standards of roads for which contribution would be made. The government could then protect itself by inspection and a refusal to make payment for any road falling below specified standards. Such a system would not require much federal machinery to administer it.

Mr. President, I fully realize that I am not in entire harmony with the dominant spirit of this great roads congress. I am conscious that a majority of the delegates here are members either of the American Automobile Association, the National Roads Association, or some other organization affiliated with one of these. You, gentlemen, are seeking to promote the construction and maintenance of a limited mileage of excellent highways, while I am seeking to secure the construction and maintenance of a general system of good roads. You believe that a few very high-class boulevards stretched across the continent would serve as object lessons to the people generally. On the other hand, it is my opinion that if we should succeed in securing a general system of average roads they would be maintained in such manner that in a few years they would grow into high-class roads. You want 50,000 miles of expensive "touring roads" to be built in forty years. I want 1,000,000 miles of "business and post roads" to be built in five years.

Now, gentlemen, I know you are just as conscientious and public spirited as I am, and it is that consciousness which moves me to conclude my remarks in an appeal to you to withdraw your opposition to a plain people's plan, which we desire to pass through Congress at the next session.

Our plan will be a modest one. It will not be expensive, and a vast majority of the people favor it. Get out of the way and let us try it out. If it fails, then we can take up one of your more ambitious schemes.

In the last Congress we passed through the House a bill providing a yearly contribution to each mile of roads in the States which should be constructed and maintained according to specified standards. Although vigorously opposed, this bill passed the House by a vote of 240 to 86. It failed in the Senate, however. I am informed that the American Automobile Association claims the credit of its defeat. How that was accomplished has not been revealed.

Had that bill become a law it is my candid opinion that within one year it would have given us 50,000 miles of improved roads and in five years would have given us a million miles.

As a warrant for this expression of opinion let me cite some facts. Last winter the legislature of Missouri passed a bill modeled after ours, providing that every mile of road in the State leading from county seat to county seat which should be built up to specified standards should receive aid from the State to the extent of \$15 a mile. The State highway commissioner, who was charged with the duty of administering this law, refused to accept any road which was not 40 feet wide between fences, 30 feet wide between side ditches, so graded and crowned as to quickly shed water into side ditches, and provided with all necessary culverts, to be of stone or concrete. These are rather hard specifications. Yet that law has been in operation in Missouri only about six months, and 6,000 miles have been accepted by the State highway commissioner as having been brought within the provisions of the law. In many cases where public funds were not available, money, labor, and material were contributed by private persons. Within a year this \$15 a mile stimulus will have given the people of Missouri 10,000 miles of good roads. Had the same thing been done in the other of the 48 States a single year would have given us 480,000 miles of good roads.

Recurring again to Missouri, Governor Major, by public proclamation, set apart August 20 and 21 as road days, upon which he requested all able-bodied men to work the roads. Two hundred and fifty thousand men responded, and it is estimated that in labor and material there was more than a million dollars put upon the roads of Missouri during those two days. Later the governor of Arkansas issued a similar proclamation with similar results.

These facts warrant me in feeling that if the federal government would stimulate the road movement by a very modest aid per mile of improved roads astonishing results would follow.

Another lesson to be drawn from the facts which I have just cited from Missouri and Arkansas is that the States, the counties, and the people can be stirred to action, and that it would be unwise to take away from them the control of their roads and transfer it to Washington.

Mr. President, I repeat that if only moderate encouragement by the United States is given to the States and local authorities we shall in five years have a million miles of good roads—roads over which you gentlemen may in comfort tour any part of this great country of ours.

Won't you "come over and help us?"

THE CHAIRMAN: I am sure, gentlemen, it is a very great pleasure to us all to listen to Judge Shackelford, to listen to his able address. I know to us motorists, especially the poor ones, like myself, it is very pleasing to be put in the plutocratic class. After having hard work to pay my office rent in Buffalo and take a day or two off, I love to close my eyes as he talks and see myself swimming in millions and revelling in luxury and splendor. However, the practical training I have had makes it very difficult for me, when I take my lead pencil and revert back to the mathematics they taught me before I practiced engineering, to figure out how, if it takes forty years to build 50,000 miles of roads, you can build 1,000,000 miles of roads in five years. That is something like the problem, "Why is a hen?" and while, of course, I am not going to take any time here in debate, because I am only supposed to introduce the speakers, I do not want Judge Shackelford to go away with the idea that we want to build 2 per cent of the roads and let the other 98 per cent go. The federal government can care for 2 per cent and the State and county and township to care for the other 98 per cent, and they can do it far better when they have their trunk lines built.

I would also call your attention to the fact that you cannot build a business road without building a motor road. The motorists will go where the roads are built and if they are crowded with farmers, so much the better. The day before yesterday I took the Judge from Buffalo to Niagara Falls in my automobile over a road that the State has built and over which the farmers bring 15,000 tons of produce to market from the grandest fruit country in the world. Then we went to Niagara Falls. It was the first time the Judge had seen it and we showed him the power development, which takes one-seventh of the water, and he says: "That's the best part of it, in time those Falls will run dry; you fellows with your aesthetic ideas are all wrong; commercialism will rule this country. It is wise that every bit of the water should be for commercial purposes and we poor farmers will then get the benefit of that water." Then I took him to Goat Island and showed him the trees and shrubbery and told him that every form of growth in the State of New York is represented on Goat Island; it is in its virgin state, has never

been touched. He said, "It's grand, it never should be touched, it should be left just as it is." I said, "No, Judge, we will have to cut down the trees and make lead pencils of them."

Then we came up the Canadian shore—on the American shore we can't go along the river; it is teeming with factories, with commercial development—but on the Canadian side there is a strip of 100 feet wide, and we went along the river's edge from one end to the other, and the Judge forgot himself for a moment and said, "This is grand, they are away head of us on this side."

I want to say that the real test of the right way of building roads is to actually put it into practice. In the State of New York, in 1895, there was appropriated \$50,000,000 for building State roads, constituting 10 per cent of the total mileage, 4 per cent State mileage, 6 per cent county mileage, leaving 90 per cent untouched. After they spent that \$50,000,000, the people were asked to vote on another road proposition. There were counties in which there wasn't a mile of road built or proposed to be built, of these main highways, but what was the result? The second \$50,000,000 was carried by a bigger vote than the first; there wasn't a township or highway district or county in the State that didn't vote in favor of it and by an increased majority over what they had voted for the first \$50,000,000 appropriation in 1895, which showed what the people wanted. It showed that when we build the main highways, the local people will care for the local highways. In New York State it was possible to pass that \$100,000,000 appropriation, partly because we had such meetings as these.

When you people go home, you meet a few constituents, but we would be entirely lost without the great press of the United States. It is the newspapers of this country who are more responsible for the good roads movement than any other source, and of the newspapers there was one man in New York State twenty years ago who had the keenness of perception to see what the road problem meant in this country and fight for good roads, and that man has fought for good roads from that day to this and he is here today, and it gives me great pleasure to introduce the proprietor of the *Evening News* of Buffalo, the greatest good roads daily in the United States, the Hon. Edward H. Butler.

ADDRESS BY EDWARD H. BUTLER

I did not expect to meet such a strong advocate for letting everything alone in the way of federal aid as Judge Shackelford. I have heard of him and know what he is capable of. He is one of the ablest opponents we have and we will have to watch him when he gets back to Congress.

But first of all, I want to call your attention to something that happened in New York last night. The newspapers of Detroit, to which my good friend, Mr. Diehl, pays tribute, contained the news this

morning of the sad fate of Lieutenant-Governor Woodruff, of New York. He has been a strong good roads man and pike man, and it was by reason of the interest that he took in good roads that we have sidewalks along the farms made of cinders, by which the automobilists could find safe journey to the next town, and that and other things for which he was famous made him lieutenant-governor of our State.

I move you, Mr. Chairman, that a resolution of condolence and sympathy be sent today as the expression of this convention, to Mr. Woodruff. He is not in immediate danger. The 'phone tells me that he is resting easily, but will never recover the use of his side, and it may terminate fatally within twenty-four hours. He addressed the Association for National Good Roads four years ago in Chicago.

I spoke on that occasion and made a prediction which is verified here today, that it would be four years more before you had them. I do not want to say that, with the strong, strenuous opposition of Judge Shackleford, it will be another four years, because now that we know him and know what we have got to contend with, we will get busy.

I have heard the term "de luxe" used inadvertently here two or three times, and "wealthy aristocrat," in connection with good roads. Now, does anyone think for one minute how much money is spent for labor in making these automobiles for the "leisurely rich?" I do my share in buying them. I have the largest number of private automobiles registered at Albany of any man in my State, and still I am looking for another. If something new comes on the market, we get it.

Now, we want to speak about what we did in New York State. There was a lot of highway money wasted. Governor Sulzer came in and said, "Gentlemen, you have got to spend every dollar honestly in the construction of these roads and I will put men in to make you do it," and he selected Mr. Diehl from our end of the State. We knew him, we knew his worthy father, who had been mayor twice, and refused, almost at the point of the bayonet, to accept another nomination.

The engineer had more than he could do in the private practice, yet he yielded to the public call. They asked him, "Don't you owe something to the State? We know you are honest and will trust that you are not ignorant." Immediately, Governor Sulzer became the target of the rabble that couldn't get a contract to do nothing and draw money, and the result is, they are trying to crucify him now. That was the inception of the whole business. We can't do this thing of building good roads honestly by States alone, Judge Shackleford notwithstanding. Look at the State of New York and the money that was squandered. Half the stuff they put down this year would be over in the fields next year.

We want federal inspection and control. Let the inspection start with the trunk lines and the others will follow. I go through Europe every year in my automobile and hope I will do so as long as I live. This year I can't go on account of this meeting. I have seen the trunk lines, I have seen the lateral roads left unfinished, but they have brains enough to get over on the trunk line and go to the nearest town. We cannot do everything at once.

I was one of the committee, being a member of the Waterways Congress, who went to see Uncle Joe Cannon, who lives not far from here and who is going to run again. He raised both hands and said "\$6,000,000—great God! Where would you get it?" The next day he knew, when the governor of Alabama got on that platform, succeeding Mr. Taft, and said, "If anyone gets in the way of your doing what you should do for the people, throw him off;" then Uncle Joe saw a new light; he didn't hand us out the \$6,000,000, but he wasn't so reluctant as he had been the day before, and the wonder where it was to come from never happened to enter his breast. He said, "If they want it, I don't care; it's the people's money."

Don't be so sparing of the federal money; go ahead, let Congress do something; let it begin and we will take care of the other, and these leisurely rich. How many rich men are there who own automobiles compared with the poor man? Mr. Ford—and I am willing to give him the benefit of this advertising—said he was going to build 300,000 automobiles next year here in Detroit. What does that mean? Are there three hundred and odd thousand rich men ready to buy that Ford? No, they will go to the poor man, and the farmer and the farmer's daughter and to the farmer's son, and his grandchildren; they will be running those Fords, because they cannot afford to buy a more costly machine. Don't you think they are interested in this as well as the five or ten thousand leisurely rich?

Mr. Enos, the head of one of our great Buffalo institutions, is a man of large affairs, a manufacturer employing thousands of men, a rich man, and he is doing more to help the poor man than any poor man has ever done. Now, that is the truth. Mr. Diehl, to my own positive knowledge, because I talked it over with Mr. Argyle, didn't want to become associated with good roads; he had more than he could do in his private practice. There's a lot of new building going on down our way. We are not inspired by the success in the manufacture of automobiles here in Detroit, but we are doing very well.

You passed us in population because we were asleep; we were afraid the federal government would do something to help us along, but we have better roads than you have here. I don't want to say that I know all about the roads in Europe, but I want to see the roads I don't know about in Europe. Why, just think of it, Appius Claudius built a road between Rome and Naples 300 years B.C. and

that road is better today than this road from here to Jackson that was built two years ago.

That is contractors' graft; that's what I mean. It is not that our States cannot do it, but they won't let them do it; the politicians have got it in their hands; you have to go down and grab anything back from them. We have had it. Some of them are going to jail for it, too. Let the federal government help us all they can. I use the collective noun in the plural, "they," because the government is comprised of eight or nine strong men like Brother Shackelford and some others. They will let him go on and the rest will sit back and say, "That's so."

I hate a "that's so" man. Get out and see what you can do for yourself. I haven't told you gentlemen a word that is untrue. I know how fast they are going to do this thing over in Missouri, but you will have to show me. My good friend, Colonel Nelson, of the *Kansas City Star*, than whom there are few better automobilists (I have been abroad with him and raced with him), is always telling us, "We are going to have that thing fixed within a few days; come up and see us." He spoke last night and told us how much we'd get up there and I am going up to see it. I am from Missouri now and the Colonel will have more excuses to offer about being more hampered by contractors or men who furnish materials than we are.

Now, gentlemen, I do not want to take up any more of your time. I might talk here on the European roads and tell you what you can get; so well were they advertised that the road leading all the way down to Naples was cut up with ridges, after that book, *The Lightning Conductor*, was circulated and told about the beauties of that trip. Millions of dollars every year are left there. I talked with Mr. Coliet, of the Automobile Club of France, of which I am a member, and he said, "We are going to get \$500,000,000 this year out of you Americans," and I guess they are.

I have a son down in the Italian Lakes with his wife now and he said, "I can't get through until the 23d of October," and he commenced September 8th. Why is that money left over there? There isn't a more beautiful tour in the world, more beautiful scenery, more alluring and everything, and nature has been generous to us, than the Hudson River country from New York to Albany, yet we hear all about the other side, go over to see it, come right back home. Of course, I am only furthering the argument of Mr. Shackelford when he said, "See your own country first." I am willing to if I can ride in an automobile without a spike, a blow-out or a puncture every 40 feet.

I do wish today that this Convention, composed at it is, of the smartest lot of men I have ever met in any convention—politicians are here, members of Congress are here, and the Southern Railway President, Mr. Finley, is here, though what he is doing in this company I don't know. Someone said down in Richmond that we'd leave the railroads out of business. Well, some of them ought to be left. When we get good roads down through that country they will be left.

I own a winter home in South Carolina and up at Columbia they got that far with the road that the *Atlanta Journal* and the *New York Herald* are promoting, but they don't get money enough to bring it on down and that road has been a failure. Now, if the federal government did what they should, they would give that poor, oppressed, ground-down southern country a lifting hand; that's what they should do. There are thousands of us, probably many through sentiment and others for climatic reasons, who would buy plantations en route to Atlanta. We'd stop over, entertain our friends and have model farms.

I have one in New York State—yes, we are a leisure-loving class, a de luxe class and all that, but going down there to our ranches over a decent road, what would be the result? That country would boom. We will put our money in there and help them along. We owe that southern country \$100,000,000 right now. I dare stand up as a Republican—and they recognize me in my party—and say that if we were in their shoes we would never get up in God's green world! No, sir! That country was devastated; everything was taken away; they were crushed down and left nothing. War is hell. Well, with them it was two hells, that's all there is to it.

I want to see the South get a little of this money, this federal aid; it's the least we can do. After we whipped them we went right in and despoiled them and we followed that up with our carpet baggers, sent down to annoy and tantalize that glorious people, and now, when they ask a little aid from the federal government, they should get it. I am ashamed to say that some of my people are opposed to it. Now, let the government do all they can and we will do the rest.

We know that we are going to have good roads around Buffalo and Niagara Falls. Why, Mr. Carlisle said I knew when he appointed Mr. Diehl the manager of this western part of the State, that things would come right, and they have come right. You can go to Niagara Falls now without getting out four times and having everybody get off the back seat—"Come ladies, got to get the jack."

It got to be so bad that we wouldn't go any more, and one cruel beast of a man said his wife was always running the front of the car from the back seat; she'd say, "That's right, John, run it right in that hole; I saw it from the back seat and you couldn't see it from the front; why don't you get out and ask somebody where we are?" Yet, I suppose, if it was to do over again, I'd marry her again. I told her so and she said, "I'll bet you ten dollars you wouldn't."

The ladies are always running cars. I bought one in Chicago, that everyone of my family can run. We can't meet every year and do nothing. I hope this Convention will be in favor of the federal aid plan. Let them start; if they go bankrupt we can put in a little and help them out, but I want to see something done that is tangible.

Mr. Diehl went up against the hardest proposition that you ever saw. We had been stolen blind and hadn't been able to catch the thief, but after he gave us good roads and saw that the material was there to mend the roads when they got holes in them, if we did feel plutocratic; we held our fingers and thumbs here and were the leisurely rich. If a market boy had a little Ford he could go over and assume the air of greatness if he had it not. I think it's an upbuilding proposition and the sooner we can get so we can go down South into that wonderful country and see our own country first, the better.

You can't see that country now unless you ride on Mr. Finley's railroad and that's a train de luxe that goes from New York to Florida and doesn't stop en route for poor people; the poor people have to take the freight trains. I think Detroit, with all it has done to promote touring, should get busy; come down and see Mr. Diehl or Mr. Enos and he will come up here and build more than thirteen miles of road in every direction out of Detroit; that's what they tell me they have.

He will put an electric light on a pole a mile high, so that you can see the mudhole. Get busy right here. This Convention will bring forth fruit, I am sure of it. Look at the price the gentleman (Mr. Shackelford) starts off with! The initial cost of brick is too much, but if he was thinking of the road Mr. Diehl builds, the road that will stay, he can do it for \$11,000 a mile, Mr. Davis, his authority, notwithstanding.

You know the old story that Joe Cannon told in one of his speeches about the young couple wanting to be married and they were looking at furniture and the fellow thought it was too high. He said, "Twenty years from now I can buy that dining room set for about two-thirds of the money." "But, Joe, in the meantime we have been missing a lot of fun."

Now, gentlemen, I am in favor of just one thing; Uncle Sam has the money and he has the disposition, and has nearly two-thirds of the people with him, so let him help on this road proposition; he can do it. Let him control it and let the others get in when they can. It is so in Europe; it certainly is in Germany, which is beginning now to go all over her roads.

The Kaiser belongs to that leisurely class, rich and plutocratic and something else. He goes over the roads and if things are bad he gets a jog and the secretary is always in front. "You get after the highway commissioner and tell him it's between 36 K and M," and he's out there by daylight with a gang of men fixing it. Somebody asked the Kaiser if he wouldn't take a ride in this country. He said, "No, sufficient unto me is the evil roads I have here."

But next year we will get it. The roads are carrying big wagons and all that. Do you know what this means to you people? In Chicago they are running automobile trucks with express to Milwaukee on account of the expensiveness or slowness of the express service. I had it up with their agent. It is about as bad down our

way; they are going to put in a trunk line between Rochester and Buffalo, 78 miles, over a beautiful road. They have been trying it for two years between Niagara Falls and Buffalo.

They tell me the railroads want to see these good roads; well, they have changed their tune if they do; I don't believe them; I don't believe they want it, but they will be in it, don't forget that; they will be with you, and if they can hold back any improvement on the road that foreshadows any degree of competition with them, look out for them. I thank you, gentlemen.

THE CHAIRMAN: There are men in Congress who do not take the same view of the road question as Judge Shackelford. In the delegation of 16 Congressmen from Missouri, all but one lean toward Judge Shackelford's view; the other man takes a contrary view. The mere fact that that one man is equal to his 15 colleagues from the State is a slight indication of his great ability. He is also known, and deservedly so, as being a silver-tongued orator, the most eloquent Congressman west of the Missouri. It is a pleasure to present the Hon. Wm. P. Borland, member of Congress, from Kansas City, Missouri.

ADDRESS BY HON. WM. P. BORLAND

Member of Congress

No man could live up to that introduction, so that I am not going to attempt to do so, but I am very glad to say that Missouri is fortunate in being represented here by two members of her delegation. That indicates the substantial interest that Missouri has in the cause of good roads. It is fortunate also in another respect, in that it may clear away from your minds some misapprehension that we have only one idea of roads out there in Missouri, and that is Judge Shackelford's idea. My congressional district is but one county, containing a city of a quarter of a million people and a very prosperous rural section, containing about 2200 farmers, about 6500 voters in the rural section; that county, Jackson county, contains 300 miles of the highest grade of improved rock roads with oil binder, that are passable 365 days out of the year, and no man can go out there into Jackson County, of all the counties in Missouri, and tell the farmers that we don't want a high grade of roads. People out there have learned by actual experience, so that we have taken a different view of it than is sometimes taken in other sections of Missouri. I find there are more automobiles—I don't own one myself and therefore I am not in this plutocratic class, but that is not due to any lack of inclination, that's my misfortune not my fault—but I find there are more automobiles owned by the farmers than by any other class of citizens in my District. They are not the high grade automobiles, they are not the expensive kind, but

they are automobiles suited to the country user. I heard about a man down in Judge Shackelford's district, 103 years old, and some fellow came out from New York City, looked this man up and wanted to engage him for a show, a museum. He went down there and found the old fellow and found it was all true; he was 103 years old, had a family Bible to prove it. The showman from New York said, "Well, I'll make a contract with you; I'll give you fifty dollars a week and expenses to come with the show." "Well," the old fellow said, "that sounds pretty good to me, but I can't close the deal with you right now. I've made a rule all my life not to close up a business deal without consulting Pa." The fellow says, "For the love of Heaven, where is your Pa?" He says, "He has gone down town to show Grandpa how to run his automobile." If I believed in the doctrine that Judge Shackelford has enunciated, of course I would be opposed to federal aid in any form, and I would not be here and this Convention would not be here. If this be purely a local enterprise and amply and thoroughly handled by local initiative, then there is no justification for federal aid in any form. If the uniformity, efficiency, economy, scientific perfection, utilization of advanced ideas of construction and maintenance, if, in other words, the reduction of things to a business basis, is not necessary, then there is no justification for our acting in larger bodies. We ought to go back and act solely in our small and local bodies. If I believed it was not to the national interest to spend a dollar in your road district, except the taxes that were collected in your road district, then there would be no justification for our meeting together. If it were not true that the great wealthy centers of population in this country stand ready and ought to stand ready to contribute to the development of the less developed sections of the country for the common prosperity of the whole nation, then there would be no basis for federal aid. If it were not true that a commercial metropolis of a State, like Kansas City and St. Louis, had a vital interest in the construction of highways and the development of Camden County or Morgan County or any county in Judge Shackelford's district, then that State would be committing a political crime if it undertook to meddle in the construction or maintenance of highways. But it is only because the concentrated wealth in New York City or in Detroit or in St. Louis, is the wealth that has been gathered in the last analysis from the farms, that it is right for the federal government or the State government or the large political power to lay its hands on that concentrated wealth and return it to the development of the original source from which the wealth came. If I agreed with Judge Shackelford that not a dollar should be spent in your little road district except what you yourselves raise, in other words, if I believe that the federal government ought not to be called upon to build a road in some other man's district, then I would believe it ought not to build a road in your district and we would get right back to the point that you could take out of the federal

treasury exactly every penny you put in and not a penny more. Under those circumstances, what would be the object in the federal government interfering in the matter at all? That is exactly the situation. If we are on that basis, we are on an entirely different basis from what we think we are. But I took for my text the words of the secretary of agriculture yesterday, "those who fear the power of the federal government had better take counsel of their fears before they approach the federal treasury." For you gentlemen have every dollar in your road district of taxable wealth that belongs to you, and if you want to keep it there, if you want to fence yourself off from the rest of the world, if you want to dig a moat around a parapeted castle so that we cannot break in, you have no basis on which you can appeal to the federal government at all. This matter of good roads is engaging public attention on a scientific and businesslike basis for the first time, practically for the first time, in the history of our country. There never has been such general and widespread interest in good roads. It indicates that there is some insistent, natural and well-justified public demand for a solution of this problem, and that is reflected in Congress. There are many men who are willing to shout enthusiastically and talk glittering generalities about the improvement of roads, but there are mighty few men, in or out of Congress, and I can say with certainty there are mighty few men in Congress, that have the boldness to grasp the necessary factors of the situation. For a hundred and fifty years or more, in this country we have been pursuing the plan of building and maintaining highways, the great arteries of the nation, by means of isolated local control. We inherited that system from England, from which we inherited our other political institutions, but we inherited that system at a time when England was a hermit nation, with her forests full of outlaws, when 99 out of 100 of her young men went abroad for their education, when she had not a manufactory or a large city in her entire limits. We have attempted to adapt that feudal system of the little road district to a great nation three thousand miles in extent, that had to be carved out of the native wilderness. We have attempted to cling to that system of isolated local control of the construction and maintenance of roads, when the mother country herself has for more than a hundred years abandoned it and when no other civilized nation on earth ever adopted it. There are inherent weaknesses in the system of local control, natural and inherent. One is that the road districts vary in size, they vary in taxable wealth, they vary in their location to their neighbors and to the general community, and, more than all, they vary in their legal powers. Those of us who have tried to do anything along the line of good roads from a practical standpoint, beyond shouting with the crowd occasionally, have found that the whole subject of road laws is a legal jungle, almost impenetrable, overlapped with the accumulation of ages, choked with briars and underbrush and fallen timber. Those of us who have tried

to penetrate it in any direction have had the usual reward of pioneers to get our hands and faces scratched and torn until they bled, and that has been about the only result so far. Any lawyer will tell you that the road laws of any State in the Union are in chaos. There is not uniformity even in the laws of the individual State as to the local powers of the road districts themselves. There is not a road district in a State in the Union that has a clean-cut knowledge of the extent and definition of its own power. The road districts vary in taxable wealth. Why, it almost invariably happens that the road district with the largest taxable wealth has the fewest road problems. It has a rich, level country near a popular city, where its road problems are few, and the road district with the smallest taxable wealth has the rough country and the difficult road problems, and yet we expect those two districts to maintain a spirit of independence, almost of hostility, towards each other, for fear that there might be some coöperation that would lead to the improvement of the general highway. If that kind of coöperation is necessary between the road districts or townships of a county, if it is necessary between the counties of a State, it is necessary between the States of the Union. I had an idea when I first approached this problem, because I had had some little to do with city government, had drafted the charter of Kansas City as a member of its board of freeholders, and had had some little to do with the city government itself—I had an idea that the way the roads ought to be built was to have them built by the man who owned the abutting land on the road. It appeared perfectly clear that if the city, as most cities do, required the local street to be constructed, and in many cases maintained, by the property owner, that the same rule must apply to the country property owner. I assumed that if that were true, that the construction of a high grade street in a city along a certain block, raises the value of the adjoining property, until the cost is completely absorbed in the advanced price of the property abutting on it, that that same principle would apply in country roads. It took me some time to find out why I had any interest in the roads in Judge Shackelford's district. I discovered, in getting a little deeper into this proposition, that the value of city property consisted solely in its accessibility. You want property in a city because it is located advantageously, because it is accessible and surrounded by the city improvements, but the value of farm lands depends upon the amount of crops per acre that you can raise on the farm. If you have got a good, well-located city lot, there is no limit but the blue sky to the value, to the price you can get out of that by the accumulation of business in your neighborhood. Your farm land cannot retain upon itself the wealth it produces; if it did it would be useless to the owner and to humanity, but the farm land must send the greater portion of its wealth to the city, and we in the city do business upon the wealth that comes in from the farm, and that basis alone is the only honest and ethical basis on which coöperation must be compelled between

the city man and the country man in the construction of the great highways of commerce. Now, under those circumstances, gentlemen, I have no desire, from the standpoint of a man who represents both a city and a country constituency, to either kick the city man in the face nor trample upon the country man; it is a question of honest coöperation. I don't believe that the city man should have his property laid upon by the strong hand of the law to hand over to the one-gallus fellow that don't fix his road down in the country. In fact, I don't believe in this vanishing illusion of the one-gallus farmer; there isn't any one-gallus farmer left in my part of Missouri, and I trust in a few years there won't be any one-gallus farmers left in any part of Missouri. If that principle applies to the State of Missouri, (and it is the only honest principle on which we can justify a State tax for roads), if that applies to the State of Missouri, that the accumulated wealth of the farms of Missouri is what makes the commercial metropolis of Kansas City and St. Louis, and therefore it is right for the great State of Missouri to lay its hands on the taxable wealth accumulated in St. Louis and Kansas City and return a portion of it to the source from which it came—if that is true in the case of the state, it is true in the case of the nation. Now, that principle seems to me immutable. You cannot keep the wealth of the farm on the farm and if you did the cities would starve to death. You cannot keep the wealth of the city in the city, you must transact your business in the city with the growing wealth that comes from the country, and the same is true of the nation. Here is the great City of New York, so ably represented by these broadminded men who have spoken to you. I am glad they are, because I want to tell you that I was born and raised and have grown to political and to professional manhood, out in the Missouri Valley, the great granary of the country, and I have always had the belief and still cherish it, that if we were to cut off the means of transportation across the Allegheny Mountains, New York would be in danger of starving to death in thirty days. I have heard some men from New York get up and say, "Why should the nation lay its hands upon the wealth accumulated in the City of New York and build roads in Missouri and Montana?" And I tell them that the principle is precisely the same, that they lay hands upon the wealth of Buffalo and New York City to build roads in the interior counties of New York. The wealth that is centered in the great, glittering metropolis of this wealthy nation of ours, was not produced upon the barren streets and squares of the metropolis; it came from the rural sections, and the more of it that comes from the rural sections, the greater will New York be. New York is our metropolis, it is our great gateway to the world, it is our great export market. It draws its wealth from all the nations. Great railroads run through Missouri, but their general offices are located and their bonds are owned in New York. It is true, we pay life insurance in Missouri, but we send the check back to New York, and then borrow

it back again to get a mortgage on our farms. It is true, we have banks in Missouri, but we send our reserves to New York. It is true, we raise the crops in Missouri, but we ship them to New York, and New York will no more divorce herself from Missouri and Montana than Montana and Missouri can divorce themselves from New York. We are one great nation, and if we justify ourselves in federal aid to roads, on the theory that we are on a dishonest basis, if there be any danger in federal control, let your little road district run it to suit itself; then it will be perfectly safe and have its money in its own hands. If I believed that, I would vote against the improvement of every navigable river and every harbor in the United States. I live at the furthest end of navigable water in the United States, at the great place where the Missouri River bends to the northward and spreads out to the great northwest, the country that has no navigation. I have been working, since my service began in Congress for the navigation of the Missouri River. This year, for the first time, we had a fleet of seven boats running all the seasons, because we had the banks revetted and had no sand bar. We have got the water, the channel and the boats, and I have combatted this same idea among my Kansas and Nebraska and Colorado colleagues, who say, "The Missouri River don't touch us," and I say, "The nearer I can get it to your wheat fields the cheaper you can get your wheat on the market." If I believed in that doctrine of isolated local control, I would be compelled to vote, not against the improvement of the Missouri River, which runs by my door, but against all the rivers that did not run by my door; against the improvement of Gasconade and Osage, that run solely through Judge Shackelford's district. They are tributaries of the Missouri, but the freight they haul, by virtue of the improvements thereon by the federal government, is a part of the great wealth of the Commonwealth of Missouri. No, we cannot divorce ourselves, gentlemen, we are here as a great nation and here to coöperate. I am not a touring man nor an automobile owner, directly or indirectly. I welcome to this movement in favor of good roads every element, every class, if it chooses to call itself a class, though I don't recognize classes. I recognize every class of citizens who are willing to aid in pushing forward a common object in which we are all interested. I have no desire to kick any class or interest in the face. As long as we are going along in the same direction, we ought all to pull together as far as we can. Now, the question of federal aid has assumed a critical point in the history of our government. We voted, as you recall, at one time, to pay \$15 a mile for dirt roads, \$20 a mile for gravel and sand roads, \$25 a mile for rock roads for carrying the mail over those roads of ours. That was a mere pretence; those of us who voted for that proposition, who didn't believe in it, voted for it on the ground that it was a declaration of the principle of federal aid and on no other ground. We knew that \$15 a mile did not amount to anything, either in the construction or the maintenance of those roads. They

might possibly maintain a dirt road after a fashion, but, of course, we understood, as you understand, that a dirt road is the highest priced road to maintain and an improved road is the cheapest in the long run. It's like the difference between a wood and tin bridge and a stone arch bridge. Out in our country the commissioners used to be very fond of putting up what we call tin bridges, these rattling iron structures that rattle themselves to pieces in a few years. We had the wooden bridge idea first, then the tin bridge, and now we have got clear past it and have quit wasting our money that way. Men will quit wasting their money on unimproved roads when they see that they are no better off this spring than last and no better off this year than a hundred years ago. I believe in the higher type of road, in the better class of road, and I won't vote for any federal appropriation that does not promise the people, not a division of the federal money into a pork barrel in every congressional district, but a scientific, permanent, better class of roads than we have today. Now, mark you, my friends, I've got 300 miles of fine roads in my county, the best class of roads that are mentioned in that road bill that went through the lower House of Congress. Twenty-five dollars a mile was the price that was going to be paid. I would have taken that home to my people, \$7500 out of the federal treasury, the amount of my annual salary as congressman, taken off my coat, unbuttoned my collar, and got out on a hot day and told the people, "I brought back \$7500 of federal money." Some might have been interested in that, but lots of them would have looked on me with a good deal of pity. "What do we want with \$7500 of federal money, when our county is spending between \$500,000 and \$600,000 every year? We don't want your \$7500 and if you are a pork barrel Congressman we don't want you." That is the way the business men in my district would have acted. They would have said "If you don't go down there and solve that road problem, we don't want you tackling it at all; let it alone." We spend half a million dollars in that county on roads now and although I would have gotten the biggest sum of money out of that bill of any congressman in the State of Missouri, I would not have dared to offer it to my people. Last session we created a committee on roads; that shows that the interest is gaining ground. In the post-office and post-roads bill they put an appropriation of \$500,000 to be expended, as the secretary of agriculture told you, by him and the postmaster general jointly. That was to be spent in coöperation with the State, the State contributing twice as much as the federal government. The fact that it resulted in a glittering failure was not the fault of the secretary of agriculture or the postmaster general or the spirit in which they approached it, for no man could have approached it with more sympathetic diligence than those two. They were facing difficulties; they found that \$500,000 divided among the States equally would mean about \$10,000 for a State. Then they sent out word to the governors of the forty-eight States and asked them

to select a road and to contribute \$20,000 from the State funds or the local funds to the improvement of that section of road. Of the forty-eight governors who were invited to select, only twelve undertook to do so. I don't know how many they actually heard from, but those that didn't undertake to select their roads said it was because their State constitutions or laws of their State were in such condition that they could not cooperate with anybody on any subject and it was useless to talk to them until they had a reform in their local procedure. Twelve governors undertook to designate roads, among them the governor of my own State of Missouri, who designated a stretch of road and had the nerve to go contrary to somebody's opinion here, because he designated a portion of the cross-State highway in the county of Lafayette, adjoining my county of Jackson on the east, a smaller and less wealthy county. He designated that little strip of road there. I don't know what was the matter, whether those road districts had exhausted their taxing power or their local powers were insufficient, but for some reason or other, that \$10,000 lay there for sixteen months and Lafayette County was unable to take it. After it had laid there a reasonable time, the federal government withdrew it, and so we did not get any \$10,000 at all. Then we found there were only three States in the Union that could take advantage of that contributory offer—Alabama, Mississippi and Oregon; all the other forty-five States were compelled to refuse it. This gets right back to your State duties, which are just as necessary as the duties of the federal government. Then these officers, in their wisdom, still intending to carry out the spirit, if not the letter of the law of Congress, selected, arbitrarily, certain roads in the United States to be improved with the balance of the money. They selected one in Iowa, that is the nearest to me, in the northern part of Iowa. That information is valuable from this standpoint, that it throws a strong ray of light into this legal jungle that must be cleared away. We have got to put our axe right at the root of the tree, get right down to the place where the secretary of agriculture says the federal government can deal only with the State as a unit, then let the State perform the high function of a State to deal with its counties and local districts, and there comes in the preservation of the dignity and power of the State, but when those roads have been selected and are to be improved by the federal and State government, the initiative, the secretary says, should be with the authorities of the State and should be submitted, also, to the federal government. I am not one of those who fear the action of the federal government or are willing to take the federal government's money without allowing it a joint supervision over the expenditure of the money. I see no objection to this whatever. One of the most vicious things, one of the most dangerous things, to the cause of good roads in this country was the pork barrel idea that we will put our hands into

the federal treasury, take out as much as we can hold in both hands, take it back to our congressional districts and say, "Here, this money comes from the federal government, there's no strings tied to it, you can do with it as you please." That kind of a proposition would be the greatest detriment and setback to the cause of good roads that could possibly be imagined, in my judgment. No, if you are going to have good roads in this country, we need not talk about good roads, that's a matter of opinion; if you are going to have *better* roads in this country (that is the word I like), a higher grade of roads; if we are going to employ the scientific research of this office of public roads that Mr. Page heads; if we are going to make use of the money the federal government has already expended in acquiring scientific knowledge about road material and drainage and engineering and construction of drainage and the proper kinds of soil; if we are going to get that knowledge that has been acquired at public expense to put into the hands of the people, then we have got to have some form of federal aid by which there will be an active coöperation between the officials of the federal government and the local district. You cannot expect the officials of the local district to have within their power or financial reach all the technical knowledge that is resting unused in the archives of the bureau of roads at Washington, and that information belongs to you, it was paid for with your money. But if you want to build a Chinese wall around your road district, let your little road boss find out for himself what are the scientific requirements for maintaining permanently and efficiently good roads in your neighborhood. We want better roads and the only way to get them is to get economy and efficiency in the management. This road convention is a convention of business men. If you believed that your road district was solving the problem, you would not be here, not a man of you; you are business men and if you believed that the road district ought to solve the problem, not a man of you would have been here. You believe that the problem is too big for any one road district and that the wealth of the nation tends to accumulate in the cities of the nation, in the centers of population, and you desire, very properly, that a part of that wealth that accumulates there, the original product of the farm, shall be returned to the source of the wealth, the country, for the development of the country and the city and make this a greater, grander and richer nation and a nation of intelligence, a nation of high social activity, a nation of high development, a nation of good schools, a nation of good churches, a nation where country life is just as comfortable and just as social and just as attractive as city life; then, when you have done all of that, you will find that the old Stars and Stripes will wave from ocean to ocean, over the grandest, best civilization that the world has ever seen. I thank you.

THE CHAIRMAN: The next speaker is the chairman of the legislative committee of the American Automobile Association. We feel that we have one of the best lawyers in the country representing us and it is a pleasure to introduce the Hon. Charles Thaddeus Terry.

ADDRESS BY CHARLES T. TERRY

As I look into your faces I know it is an audience which is familiar with the historical incidents of the Bible. I am going to refer you to one of them. You know the story of Jonah and the whale, but probably you have never come across the full account of it. If you have, you have read that prior to the cataclysm which restored Jonah back to terra firma, the whale said to him, "I have inside information of the proposition that there is something which I must get out of my system." And accordingly, Jonah was raised a "perfectly good man," but as he lay upon the beach where he had been cast, you will realize that he had suffered some damage and was not exactly in the best condition; and accordingly help was called and a physician approaching him, stood in a brown study looking at him, and Jonah partially came to and looked up at the physician and said, "Are you a doctor?" The physician said, "I am." "Well," said he, "why don't you do something for me?" "Well," said the doctor, "there are seven methods of first aid to the injured and I am trying to think which one to apply." And Jonah said, "Is there anything in any of them about whiskey?" He said, "Yes, that is an ingredient in one of them." "Well," Jonah said, "forget the others." Now, we have had this matter of good roads and federal aid for roads in our system for a long while. I submit to you, Ladies and Gentlemen, that it is about time we got rid of it. We have talked, we have had a superabundance of superheated atmosphere about it and it is about time that there was some action; it is about time that the talk ripened into some concrete thing. If it does not ripen it will rot. We must eventually apply some one remedy and forget the others. Now, there are various and sundry suggestions of various and sundry ways of producing federal aid for good roads. Mr. Shackleford has a theory; Mr. Borland has another one, which is a little different, and A, B, C and D each has a particular pet theory. I asked somebody on an occasion what he thought of Mr. Shackleford's plan, and he said, "I like it." "Have you heard of any other plans?" "Yes." "What do you think of them?" "I like them." "Well, what is your idea of what a national system of good roads should do?" "Why," he said, "I only have one requirement for a national system of good roads and that is that it shall build a road in front of my door." Now, the issue is between selfishness and provincialism on the one hand and a broad liberality and nationalism on the other hand. A house divided against itself certainly will not stand. I have

heard no one in the last six or seven years, during which this question has been mooted, who is not for good roads, heartily for them, and who is not for federal aid to good roads, and the question only remains now, "What shall be the method, how shall the technical feature of it be worked out? What plans shall be followed? How shall federal moneys be applied to the improvement of the highways of the nation?" You will recall that a celebrated ex-president of this country has a daughter who sometimes indulges in amusement, not wisely, but too well, and who, sitting in one of the galleries in one of the halls of Congress, to which resort was had from time to time by various members of the House of Representatives, put a tack on the seat next to her, and one of the Congressmen, taking the seat presently, was moved to sudden action, and she was upbraided. She was told that it was cruel to cause needless pain to others. "Oh," she said, "I take no pleasure in the pain of others. I did that thing because it is the only way to see a Congressman doing anything in a hurry." With the sentiment of this country in favor of good roads and of federal aid to good roads, powerful, widespread, almost irresistible as it is, going to the halls of Congress and knocking and demanding that action be taken, that action cannot be refused; but before that is done there must be something concrete about the demand. It will not do simply to say, as we have heard said so many times during the past years, "We want good roads, we want federal aid to good roads." Everybody agrees that those things are sound, that those demands are sound; the point now is to go to Congress and say, "Here is the plan which we ask you to put in operation through statutory provision. It does not satisfy everybody. If we wait until we get a bill satisfactory to everybody, this thing never will be done. It must be a matter of concession, it must be a matter of compromise, it must be a matter of broadmindedness. Selfishness and provincialism must give way to nationalism, because if we are really a nation we must have roads national in character and national in usefulness. Hence we come to Congress. Now, what shall be the plan? We have listened to an inspiring and enthusiastic address by Mr. Shackelford, member of Congress, and a most eloquent one by another member of Congress, Mr. Borland, and a delightfully, polished interesting address from the editor. I call you to witness that there must be a difference between the intelligence of Mr. Shackelford's constituency and that represented by Mr. Borland, because they spoke about the farmer in an entirely different way; but, Gentlemen, I am not in politics, I do not want anything of politics; I am not in office nor do I want office. I am not running a newspaper, therefore I cannot speak in headlines, but I can speak, those being the circumstances, and say just what I mean, and I mean that everybody is agreed that this country is entitled to better roads. I say and I mean that everybody is agreed that the federal government must and should have a hand in their construction, because, as a

nation, it must have a national system of highways. I say and I mean that the time has come for Congress to act. The thing has been thoroughly discussed, exhaustively considered, and it is time now for concrete action. The question whether the States should control the expenditures within their borders or whether the federal government should control them, the question of how much and in what proportion the federal government should contribute moneys for the construction and maintenance of roads inside the limits of separate States, those things have been now so threshed out that we know where we stand; if we don't, we ought to know, and I say to you that some legislation on the subject is better than no legislation. Let us avail ourselves now of the conclusions which have been reached after intelligent study of the question, let us take the intelligent view of a substantial majority of all the people on this subject. Now, what is it? I submit to you a plan and I submit to you a bill and I will offer, in a moment, a resolution with regard to it, which I believe should have the approval of every man who has given any thought to this subject, a bill and a plan which I believe should be and will be adopted by Congress and made the law; a plan and a bill which may need, from time to time, as experience teaches, amendment and improvement, but which, in their substantial, general features, solve the problem and answer the difficulties which have so far arisen. The plan is not my own, the bill is not my own; the plan and the bill are the plan and bill of Senator Jonathan Bourne, Jr. He has evolved a plan and drafted a bill, not superficial, not out of his inner consciousness, but after the most painstaking, the most detailed, the most microscopic examination of the whole question, and after the gathering of statistics which anyone who runs may read and understand and approve. May I take your time for a second to give you the essential features of that plan? The distribution of the moneys, in the first instance, which are to consist of a billion dollars, is based upon a logical, scientific apportionment among the States, reached upon the basis, not of area, not of wealth, not of population, not of acreage, but of all those things. The State which is large does not get an undue proportion; the State which is small in area, but great in population, does not get an undue proportion; the State which is wealthy does not get an undue proportion, but all those factors entering into the determination of the percentage to which that State is entitled, give to each State as near as human intelligence can figure it out, just the amount which, all things considered, it should have for the purpose. I am going to take, because Mr. Shackelford mentioned it, the State of Ohio for an illustration. The State of Ohio, for example, has an acreage of about 40,750 acres. It has taxable property or wealth in the amount of \$6,200,000,000. It has a population of 4,767,000. There are the acreage, the wealth, the population. Then it has of public roads 88,000 miles. Now, there have been objections to the taking of any one of those things

as the basis for the distribution of money and those objections have solid foundations and reason to support them, but this plan takes them all, the four percentages, and takes the average of the four, so that while the wealth of Ohio might be much greater than of other States, which were entitled to as much mileage of good roads as Ohio, another State might show disparity on another one of those four elements, but take them all together, population, acreage, wealth and miles of public roads, and, Gentlemen, you get a basis which is fair and equitable to very State in the Union; and taking the average of those four bases of calculation, Ohio's percentage would be 5.2 of the moneys to be distributed, of the billion dollars which is the fund, and that gives to Ohio \$50,200,000 to be expended, 20 per cent a year. How is the money to be raised? The money is raised in this way; each State, having a highway commission, makes its application to the federal government for its quota of the billion dollars and upon its application, it deposits with the federal government its State bonds at 4 per cent for the amount. The federal government issues against those bonds its own bonds at 3 per cent, leaving a margin of 1 per cent in the federal treasury, which, compounded from year to year, will pay off all the State bonds in fifty years. The plan is so simple that it challenges our admiration. That sinking fund in the federal treasury pays off the State bonds in fifty years and discharges them and the federal government returns them to the State cancelled. The federal government sells the bonds at not less than par, its 3 per cent bonds, at popular bidding throughout the country. Now, it does involve the proposition that each State must have its highway commission, but you know and I know that no road upbuilding will be had until each State goes scientifically to work at it and has its highway commission; the thing cannot be done at haphazard. Then, it is said, there are constitutional objections in some of the States against issuing the bonds. So there are, but no State can have any good roads, under any circumstances, through its own or other efforts, without the issuance of bonds; therefore, that constitutional defect may be remedied at this time and in this way as well as at any other time or in any other way. All this I say for the plan and for the bill, which is simple and precise and clear in its terms, and there is less objection to it than to any plan which has ever yet been devised. I say it is something concrete and that is the main point. I say it is something to which everyone can attach his influence and his name and for which we may stand shoulder to shoulder in the presentment of it to Congress, and if we do, if we have reached the conclusion that this bill in its general features, perhaps subject to some modification, is what we want, then Congress will give it to us.

Therefore, if you will indulge me I will offer a resolution, which I shall ask to have referred to the committee on resolutions which has just been appointed, for their consideration and report.

ROAD LEGISLATION AND ADMINISTRATION SESSION

UNDER AUSPICES OF SPECIAL COMMITTEE OF AMERICAN BAR
ASSOCIATION

September 30, 3.30 p.m.

FREDERICK D. WADHAMS, Chairman

THE CHAIRMAN: Gentlemen the first paper on our program this afternoon is, "The Merit System in Road Administration," by Hon. John T. Doyle, Secretary of the U. S. Civil Service Commission.

THE MERIT SYSTEM IN ROAD MANAGEMENT

BY JOHN T. DOYLE

In the good roads movement the merit system is essential. The public roads constitute a series of great transportation systems which should be administered with all the business care and efficiency and all the technical skill that would be employed if they were owned by private corporations. Instead of that we have the spectacle of a hundred thousand or more road officials, most of them elective and very few of them required, under existing legislation, to have any knowledge of road construction and maintenance or to give any considerable amount of their time to the management of the roads. It is estimated that more than \$150,000,000 a year is being expended for the construction and upkeep of our public roads. It therefore becomes an important economic essential that this great outlay be expended under trained, capable and honest supervision.

Emerson has said that the beautiful rests on the foundations of the necessary. There may be abundant appropriations but without skilled engineers and freedom from the abuses of the spoils system the objects of your movement can not be fully attained. There must be feasible and reasonable ways of expending the many millions of dollars needed for good roads. There must be intelligent supervision by trained and educated road engineers, freed from political interference, if the expenditure of these millions is to secure beneficial results. Men are essential for the execution of measures. It is through the engineers down to the humblest employees that the roads are built and that the government serves its people. Practical governing is administration, and administration is the work of the civil service. Whatever will increase the integrity and effi-

ciency of the body of employees will increase the administrative energy of government and further the attainment of the ends for which government is instituted. The power of the government to carry on plans for the public good depends upon the intelligence and efficiency of the persons whose services it must employ. The efficiency of the civil service therefore touches to the utmost limits all that the government may be called upon to do.

Every advocate of good roads should be an advocate of the merit system as the vital means to an end. The need for an adequate system of administration such as will insure economy and efficiency in the highway bureaus needs to be emphasized. The problem is a technical one. It relates to securing the best qualified employees, their systematic training, the removal of those who do not measure up to a proper standard of efficiency, the correction of defects in organization and conditions of employment, the comparison of results with outlay, the measurement of service and its correlation with pay, and the collection of information concerning the service for the use of the responsible executive officers. The part that the civil service reform system takes in this problem is as an aid to the appointing power in testing the character and fitness of candidates for employment, irrespective of their politics; seeing to it that employees do not indulge in political activity, and in maintaining an efficiency system upon which promotions and removals will be based. The main essential is to take the management of the public roads out of politics, to secure skill, honesty and efficiency in the expenditure of the funds for their maintenance, and to ensure stability of administration independent of changes in control by political parties.

In the classified service of the federal government great advances have been made under the merit system. About 300,000 positions in that service and as many more in nine States and about 250 cities which have adopted that system, are taken out of politics and are subject to competitive examination. As governments grow and their technical activities expand, it becomes increasingly necessary in the maintenance of free institutions to guard against political abuses and to procure the highest grade of employees who are willing to work for the salaries paid.

The merit system of appointments was adopted in the federal government and in the State and city services of New York and Massachusetts nearly thirty years ago. The beneficial effects of its enforcement and of its continued development and increasing application are now more than ever apparent. Appointments and removals in the more than half million positions in the parts of the service under the merit system of the nation, States and cities are withdrawn from politics and made with increasing regard to the interests of the public service, and a higher order of character and efficiency is manifest in those services. The popular approval of the merit system as a means of securing economy and efficiency and of suppressing abuses due to improper political influences is nearly

universal without distinction of political faith. The American people are satisfied with the results of that system and there is no longer any organized opposition to it.

The merit system has been the means not merely of supplying qualified technical experts and of opening a worthy career of public employment to them, but of aiding the orderly development of technical work in the public service which was not possible under the debasing influences of the spoils system. Since the adoption of the merit system there has been an enormous expansion of technical activities in the Nation, States and cities and a wider field of usefulness has been opened to persons of technical education, with tenure based solely upon fitness. The public service is becoming more inviting as a field of employment, and on its technical side offers opportunity for research and broadening of training.

Many technical positions require not only high expert knowledge, but also high expert administrative ability; and the examinations held for them are systematic and thorough inquiry into the education and training of candidates, their achievements, experience and success in handling men, and ability in executive affairs. These qualifications are considered by examiners who are themselves recognized authorities in the subjects embraced. The securing of competent experts to carry out the details of administration should no longer be left to the discretion of those in authority to be affected by personal and political interests and prejudices, log-rolling and partiality. It was this uncontrolled selection that led to the spoils system. The time and efforts of those directing large enterprises should be given to the higher problems of their profession and should no longer be expended in the distribution of patronage and elections corrupted by seekers for public office. The better way is to leave the investigation of the character and fitness of candidates to skilled experts under an orderly procedure.

An illustration of the methods of testing fitness by competitive examination followed by a period of probation, let us take the examination for senior highway engineer in the federal service, the entrance salary for which position ranges from \$2220 to \$2700 a year. The duties of this position involve the superintendence of the construction of object-lesson roads of various types throughout the United States. In addition these engineers are called upon to inspect roads and investigate road-building material in counties for the purpose of reporting upon a system by which the best administration, construction and maintenance of county roads may be secured. They are also expected to inspect roads locally and to advise in regard to their improvement, and also to address road meetings. Entrance to this examination is limited to technically educated men who have had at least five years' actual experience in practical highway engineering work. Applicants are not required to appear at any place for examination, their relative qualifications being determined from their own statements under oath concerning their education, experi-

ence in highway and general engineering work and in delivering lectures and addressing meetings, and from statements concerning their capabilities secured from persons acquainted with their work. This is rather an investigation into the qualifications of applicants than an examination. The applicant is required to give the names and addresses of five persons unrelated to him who have personal knowledge of his education and qualifications and who will answer questions regarding him. Inquiries are made of these persons. He is next required to submit a statement of his general education and technical training, the institutions where he has studied, the time spent and dates, courses pursued, and degrees, if any, conferred. He must state the material facts in his career, telling of his occupations and also submit a statement of the professional and technical experience he has had along highway engineering lines, and when, by whom, and the class or character of work upon which he was employed in each case. He must also state what experience he has had in executive capacities, giving full details as to the number of men under his supervision, and the degree of personal responsibility involved in each case. In the marking his education and training have a weight of 4 in 10 points; professional and technical experience and fitness, 5; experience in delivering lectures, 1. For some positions oral tests are also required to give the examiners a better knowledge of the personality of the candidate but this is not required of the engineers. This type of investigation furnishes essentially the same bases of judgment as those which an ordinary employer of men would use in inquiring into the fitness of applicants whom he does not personally know.

Appointing officers who have had experience in employing men through these examinations recognize that competitive tests are better than those heretofore employed. In Philadelphia the chief of the bureau of highways and street cleaning, an office with a salary of \$6000, and nine assistant commissioners of highways, have been appointed by competitive examination. Experience in that city, and New York, Chicago, and other municipalities demonstrates that the competitive system is adapted to the highest administrative and expert places in city governments.

Recently Congress has authorized the expenditure by the bureau of public roads of a fund for the building and maintenance of short stretches of typical roads in the various States of the Union, and the civil service commission has been called upon to hold an examination to provide a road patrolman, whose duties will be the care and maintenance of such a stretch of road. This being practically a skilled laborer position, applicants were required merely to submit to a physical examination and their relative qualifications were determined from the results of this physical examination and a consideration of their statements of training, experience and general fitness. Each applicant was required in advance to show that he was provided with proper equipment, including horse, cart and

implements for properly caring for the road. Receipt of applications for this examination was also limited to persons living within half a mile of the stretch of road to be maintained. The compensation for this position was \$720.

Early in the current year the commission held an examination to provide eligibles for filling a position of lecturer on road economics. This examination was limited to women, the duties of the position being to address women's and children's meetings in the interests of good roads with the object of producing and encouraging an interest in the good roads movement among women and children. An effort was made to secure the services of women who have had experience in lecturing, teaching, traveling and writing for publications, and special emphasis was laid upon experience in teaching on the economical, historical and social side of road improvement. This examination was of the non-assembled type, the relative qualifications of the applicants being determined upon their statements concerning their education and experience, together with copies of their publications or a thesis on good roads, and additional information concerning their fitness secured from persons acquainted with their work.

From time to time vacancies occur in the technical and scientific force of the Office of Public Roads, requiring an examination to fill such positions. Among such examinations in recent years has been one for expert tracer and bridge draftsman at entrance salaries ranging from \$1200 to \$1500, and one for assistant chemist at salaries ranging from \$1800 to \$2220 a year. In the former, three years' experience in engineering work or drafting was required for admission to the examination, unless a person was a graduate of a technical school, in which case one and one-half years' additional experience was required. The examination consisted of methods of designing, lettering, drawing and training and experience. An assistant chemist examination was of the non-assembled type, covering education, experience and publications or a thesis. For this examination a chemical or chemical engineering education was required. The duties of the position to be filled consisted in the testing of materials for use in road construction, laboratory and field research upon the behavior of these materials in practice, and such other phases of chemical engineering as apply to the construction and maintenance of highways.

In connection with the good roads exhibits of models of sections of typical roads, which exhibits are sent by the Office of Public Roads throughout the United States, the commission was recently called upon to provide a modelmaker, capable of making such models of roads, culverts, bridges, etc. The salary for the position is from \$1500 to \$1800 a year and the relative qualifications of the applicants were determined from their training and the work which they had accomplished of a similar kind to that required in the position for which the examination was held.

Within the past month the commission held an examination for mechanical engineer at \$3000 a year for the Office of Public Roads. The duties of this position will be to initiate and carry on research in the field of engineering, particularly in conducting traction tests on highways. Application for this examination was limited to persons who have received a mechanical engineering education and who, in addition, have had at least five years' practical experience in mechanical engineering, including some practical experience in conducting traction tests. Their relative qualifications for the position will be determined from their statements of education and experience, from their publications, and from statements secured from third parties concerning their fitness for the position.

The position of assistant director in the Office of Public Roads has recently become vacant by resignation and the commission has been requested to hold an examination to fill it. An examination will be announced in the near future to fill this position at \$3500 a year. The duties are largely administrative and supervisory and entrance to the examination will be limited to persons having an engineering education who in addition have had extended experience in highway engineering work. The relative qualifications of the applicants will be determined from their statements of education and experience, both in highway engineering and in supervisory positions, and from a consideration of their publications together with statements concerning their fitness for the position secured from persons acquainted with their work.

High grade experts of mature experience do not like to exchange steady private employment for State and municipal service as conducted today, with short or uncertain terms of office, during which they are subject to dictation from politicians. They cannot afford to give up a certainty for an uncertainty and to exchange a reputable engineering practice for a political job. Those engineers who do accept these positions are under strong compulsion to be politicians rather than engineers. They are forced to look out for their own selfish interests at a time when they should be directing their full energies toward the efficient discharge of their duties. A man may be a good politician or he may be a good engineer but he is rarely both. Where, however, positions are made practically secure and where successors can only be chosen by a method from which favoritism is eliminated and sufficient powers are granted them, well qualified experts do not hesitate to submit to an inquiry into their fitness. This is not only true on the continent of Europe but has proved true in this country as, for instance, in Chicago, where the city engineer, the engineer in charge of bridges, the city auditor, the chief street engineer, the building inspector in chief, and the chief librarian, with salaries ranging from \$3000 to \$8000 a year, have been appointed under civil service rules. These competitive tests have also been successfully used for heads of bureaus in New York State and City, in Philadelphia, and in the federal service.

These tests are found to attract men of the highest caliber where the salaries are on a commercial basis. Where such systems have been in operation for a number of years, there grows up, as there has in England and Europe, a large body of municipal experts in the various branches of governmental activity, who begin their careers in cities of moderate size or as assistants in large cities and by promotion from one city to another or within the same city, reach the highest positions.

The United States army engineers are an example as a profession. They have nothing to do with the initiation of their work except in the way of advice or of the appropriation of funds and all their expenditures are carefully scrutinized by an auditor and a comptroller, who disallow any item not strictly within the appropriation and law. A very little of the vast sums which they administer has gone for corrupt purposes. The Panama Canal and our great waterways of commerce are splendid tributes to the genius of army engineers.

Public attention should be called to the opportunities for youth in the profession of road engineering as a career. Road building should be a career and not a mere makeshift. In the making of surveys, the preparation of plans, estimates and specifications for bridges, a high order of technical ability is requisite. In providing adequate drainage systems, in the selection of road materials, in making the dimensions of a road conform to a given standard, a great deal of practical and expert knowledge is necessary. There is scant provision in the way of schools for training such engineers, except as is carried on in the federal bureau of public roads or where courses of instruction have been introduced in small ways in universities. Columbia has recently introduced a graduate school of highway engineering and if there is a public demand for men qualified in this profession other universities will supply like schools. The Office of Public Roads under the federal government has a corps of civil engineer students, recruited from competitive examinations held by the United States civil service commission. These positions are limited to young men who have received a technical education and who desire to enter road engineering, and are designed to offer practically a post-graduate course in engineering to such students. Part of their time is devoted to office and laboratory work and the remainder to practical road building in different parts of the country. The position pays \$720 a year and from among these young engineers many of the highest places in the Office of Public Roads are filled.

A standard of administration will be developed in time and generally adopted. Such a standard will require the enactment of civil service laws by the remaining States, under which it will probably be necessary that the county board of commissioners or supervisors should retain the power of appointment of local road officials but their appointees will be required to meet the tests and conform to the regulations prescribed by the proper State department. The

fact that there existed a body of trained experts to carry on the work with a well-planned system of administration would inspire the public with confidence that the vast sums necessary for appropriation will be wisely expended and not constitute a bribery chest for political spoils.

The State and city governments which do not have merit laws should be urged to follow the example of the national government and the larger States and cities and place their services upon a merit basis. Because of the efficiency and stability in the administration of the executive civil service in the national government and its freedom from political abuses the public is looking more and more to the national government to do things which under our scheme of government properly should be done by local authorities. It is urgently necessary that the local governments should realize their duties and responsibilities in this regard. The demand is widespread that the people shall be efficiently served, that their common affairs shall be honestly and intelligently administered, and if the local authorities do not meet this demand there will be increasing centralization in the government of the nation.

THE CHAIRMAN: The next speaker on the program was to have been the Hon. James R. Marker, State highway commissioner of Ohio, but he is unable to be here this afternoon and we will move on to the next part of the program. It has been my experience in various organizations that the secretary is a very important member, and in the language which prevails in this town, in describing him I would say that he had to be the pitcher and the catcher and on first base and second base and third base and in the field and stopping everything that goes wrong and seeing that everything goes right. I am sure that Mr. Pennybacker, if his services and his words of wisdom were to be expressed in dollars and cents in his name, he would be called "Million Dollar Backer" instead of Pennybacker. We will now listen to Mr. Pennybacker, his subject being a plan for simplifying road legislation in the States. Mr. Pennybacker.

A PLAN FOR SIMPLIFYING ROAD LEGISLATION IN THE STATES

BY J. E. PENNYBACKER

Secretary American Highway Association

Some years ago I had occasion to have a little talk with a bookkeeper in a railroad office, and while I was talking to him, a man came in and shook hands with the bookkeeper and said, "I am very glad to see you, General;" and after the man left, I said, "Why does he call you General? I didn't know you had such a title."

"Yes," he says, "I'm general bookkeeper." Now, there are secretaries and secretaries. Yesterday you heard a secretary who has given a great deal of prestige to the title of secretary, and then there are secretaries who bury themselves back in a corner somewhere behind a lot of papers and register delegates and do things of that sort, but who do not aspire to the dignity of appearing before the delegates on the lecture platform. That is the kind of a secretary I am. I am not going to attempt to make a speech; I am going merely to make a suggestion to you and, following the rule of newspaper men who say, "Tell the story in the headlines." I am going merely to give you the headlines. The plan I have to suggest is this; that this American Road Congress constitute a committee which will be charged with the duty of conveying to the governors and legislatures of the several States, a proposal that each State designate an official or a commission to codify and assemble the road laws of the State. That is the first step. Second, that that official or commission be authorized to become a member of an official interstate commission composed of similar officials or commissions and that these men proceed with this great mass of information which they have gotten together, to boil it down and to recommend to their respective States, the simplest, most clear-cut, most politically free road legislation that can be conceived. Now we all know that for over a hundred years, such of the members of State legislatures and particularly of the new members, who knew little of parliamentary law and less probably about roads, would introduce road bills as a last resort when they could think of nothing else to attract attention from their fellow citizens. The result has been that the road legislation in all of the States has grown piece by piece, just as you see some old houses that have been built, first one room and then two and then three and then a second story and then another story, until you have a ramshackle building that presents all the styles of architecture from Queen Anne, as they say, to Mary Anne. Now it is almost impossible for the men who are actually students of road legislation in their own States to keep up with what laws are in actual effect in the State. I talked to a prominent road man some time ago who said that road contracts were held up in his county because they could not tell under which of three classifications the road came and a different financial plan applied to each one. We all know that the greatest bane of road administration in this country is politics, and the only way we can remove it from politics is to have a plan suggested by this non-partisan, unbiased, interstate commission which will combine the best features of every State law and recommend to their respective States that which is applicable to them. In the first place, they will find that there are certain features which are common to all the States. They can lay that down as a foundation, basic principle. They will then get on up with their structure until they come to a point where the conditions in the States are dissimilar and they must

change, have this sort of a law for Massachusetts and this sort of a law for Mississippi. For example, Massachusetts might say, when it comes to legislation for working convicts on roads, "That will not apply to conditions in our State; we don't have the climatic conditions, and we don't have the same type of labor you have in Mississippi." On the other hand, Mississippi might say, "Convict labor on road work is for us the most effective, equitable and practical use of the convicts," and so there you come to the lines of diversion. Now the man from Massachusetts will proceed along his own lines to write in the legislation which is applicable to his State; the man from Mississippi will write in the legislation which is applicable to his State, but the man from Massachusetts may find that the man from New Hampshire and the man from New York can give him some very valuable points in framing the law for Massachusetts. The man from Mississippi may find that the man from Georgia and the man from Alabama can give him some excellent points for inclusion in his law, and so, with this unbiased, non-partisan commission recommending a system of legislation free from politics, you will have the best possible chance of putting through the legislature of the State the laws for which we have been waiting for over a hundred years. Now, the American Bar Association, under whose auspices this meeting is held this afternoon—if I am incorrect in this, please correct me—has a committee on uniform legislation, hasn't it?

THE CHAIRMAN: Yes, Mr. Terry is chairman of the committee.

MR. PENNYBACKER: Therefore we know it must be a good committee. When such a commission has completed its labors and recommended to the State the legislation that should be enacted, I have no doubt that the entire power and force of the American Bar Association will be thrown back of that legislation and put it through in spite of all the obstacles that petty local politicians may oppose to it. I am not going to make a speech. I think I have given you clearly what I have in mind. It may not be worth while. I had a friend in Washington, a newspaper man, who would always, after talking for hours and talking everybody to death, wind up by saying, "Well, boys, I guess I'll go up to my room and write a little rot." He was asked, "Why do you say that? Why don't you say, 'I am going to write a little,' we all know what you are going to write." I will give you the suggestion for what it is worth and Mr. Huston, who is chairman of the Ohio commission for State road laws, is here prepared to tell you how they are going about it in Ohio, and I earnestly hope that this session will take steps to get some such plan under way, because, after all, the problem is not merely to solve the problem of national legislation, but it is equally important to solve the problem of State legislation.

THE CHAIRMAN: Ohio has produced two of the greatest men this country has ever seen. I am proud to say that one of them is today president of the Association I represent. We will be very glad to listen to Mr. Archibald H. Huston, of Columbus.

ADDRESS BY ARCHIBALD H. HUSTON

Mr. Pennybacker rather misstated the facts when he stated that I was here prepared to say what the Ohio commission, appointed to revise the road laws, is going to do. His story about the house built of many rooms, many sizes, many shapes and many colors might apply to the road laws of Ohio. I have said on two or three occasions that Ohio is a prolific State. Among things we raise are pickles, and a gentlemen from an adjoining State is advertising fifty-seven varieties of Ohio grown pickles. We in Ohio have fifty-seven varieties of road laws and it takes one lawyer to interpret them and four judges to decide which law is applicable to any particular piece of road that the people may undertake to construct. Now, the commission appointed by the governor, in accordance with a legislative act, has merely begun its labor. They are seeking information. They come here to Detroit in a body to seek information; to listen to what may be said, and with the desire to take home with them valuable suggestions. The commission has gone, I might say, just this far; it has decided unanimously that, so far as possible, the various road laws of the township, the road district, the county and the State shall be uniform in their plans of construction and in their plans of operation. In that part of the law providing for State-aid or State construction, will be extended a hand to the federal government seeking federal aid for federal roads. Further than that we have not been able to decide just what plans or what course to pursue. We have sought information from every State in the Union. Ohio, while one of the oldest States in the Union, has gotten its road laws into a very chaotic state. As Mr. Pennybacker has properly said, a great many legislators, lacking something else to present, would present a road bill applicable to their particular district and suited to the wishes of their constituency and I cannot help but say, in accordance with Mr. Pennybacker, that there is a great need of uniformity. There is that same need of uniformity of State laws applicable to reconstruction and maintenance of roads that there is to other laws. There is a commission in existence, of which Mr. Terry here is chairman, on uniform laws and uniform legislation, and I believe that I can say truthfully that some of the best laws for the citizens of Ohio that have been enacted in recent years are those laws recommended by Mr. Terry's commission. I do not know of but one or two States, for example, that turned down one very important law (that is the warehouse receipt act, so-called in which I happened to be personally interested) that was recommended by this commission on uniform laws. It is reason-

able to suppose that the same is true of road legislation, and I most heartily endorse, and am sure the commission will stand with me in endorsing Mr. Pennybacker's suggestion of a joint commission, an interstate commission, to undertake to codify and rewrite the laws of the various States and get them on a uniform basis. Gentlemen, permit me to take this opportunity to extend to you all an invitation to offer, and we beg of you to give us, any suggestion that you may have looking to the betterment of the road law situation in the State of Ohio. Our room is No. 318 at the Pontchatrain Hotel and we will be glad to welcome any of you there and hear any suggestions you may have to offer. I thank you.

MR. PENNYBACKER: Mr. Chairman I don't like to inflict myself upon this audience twice in so short a space of time, but one of our troubles has been that frequently if an idea is either good or bad, it dies in the meeting. Now I want to make a motion that the chair be authorized to appoint a committee of five to confer with the committee on uniform State laws of the American Bar Association, for the purpose of ascertaining if any feasible plan can be worked out in a coöperative way with this committee on uniform laws, looking to the submission of some plan to the governors of the States and the legislatures of the States. Therefore I move that the chairman be authorized to appoint such a committee. (Motion seconded.)

THE CHAIRMAN: Gentlemen, you have heard the motion. I would suggest that it might interest you, I am sure it will, to listen to a few words from my brother and friend, Mr. Terry, who is chairman of our commission on uniform State laws. Mr. Terry.

ADDRESS BY CHARLES T. TERRY

This makes me distinctly a repeater. You had to listen to me this morning, those of you who were here, but I am always and everywhere glad to speak on the subject of uniform State laws. I am going to be very brief and I am going to make my points and then I am going to stop. I don't know much about public speaking, but there are three cardinal rules which I do know are good rules, and one is that a speaker should stand up so that he may be seen, and the next is that he should speak up so that he may be heard, and the third is that he should shut up after he has finished. Now there is one trouble recognized everywhere I think in our country, about our system of government, our dual system of government, whereby the federal legislature, called Congress, is enacting laws applicable throughout the whole country on various subjects, and each separate sovereign State is at the same time enacting laws for that particular State, which laws may be at variance with the laws on the same subject of every other State and also at variance with the laws enacted by Congress on pretty much the same subject,

so that at times no individual can know where he stands with reference to any particular right or any particular crime which may have been defined by statute. I find that confusion nowhere in clearer form than in reference to automobile laws and road laws. Any man who happens to pass over the imaginary line between two States in this day is more than likely to become a criminal without the slightest consciousness on his part that he is becoming such. Now, that is an absurd situation. It is not consonant with common sense; it contravenes all reason, because I submit to you that there is no such distinction between one community of this country and any other community of this country, no distinction arising from geographical positions or climate or social situation, which would justify the enactment and enforcement of different laws, different jurisdictions, regulating the use of the highways by the automobile, for example. What is necessary for the protection of the highways in California is equally necessary for their protection in Michigan, and vice versa, and yet you put the various laws of this country in parallel columns and see what you will find. No man possibly could know them all; no one possibly could obey them all, because if he kept in mind and obeyed implicitly one law, he would be violating another law, the law of another State when he has passed the imaginary line which divides two States, and there you are. I say it is an unreasonable, an outrageous, an absurd situation. Now that situation has got to be cured in some way. There is no argument for any but a uniform law governing that same subject in all of the States of this country. That applies not only to automobile laws, that is to say, laws regulating the automobile; it applies to many other subjects. It applies particularly, as has been suggested this afternoon, to the road laws, I mean the laws not regulating the use of the roads, but regulating the construction and maintenance of a system of roads, and that is the topic upon which we are at the present moment. What would be said, for example, if every State by statutes required a different gauge for the steam railroads or the electric railroads of the country, so that the gauge in one State would be 4 feet, in another State $4\frac{1}{4}$ feet, in another State $3\frac{1}{2}$ feet, in another State 5 feet, and so on. It would simply mean that there could be no interstate traffic on railroads, which use rails, at all, because the locomotive and cars coming to the border of New York and intending to go into Pennsylvania, could not go on because there would be a difference of several inches between the gauge of the two roads. The commerce of the country would be strangled; there could be no such thing as national commercial transactions and yet that situation would be no more ridiculous than to have laws governing matters of interstate interests, variously and divergently providing for the other operations or transactions of citizens of the country. Now we talk about States' rights which could interfere with the enactment of uniform laws. If they did, they would not be any longer States' rights, they would be States' wrongs. It is

a matter of common sense that things which are of general application should be governed by general, uniform State laws. Well now, there is a way of obviating this difficulty. It so happens that not only the American Bar Association has at the present time a committee whose duties are concerned exclusively with the making uniform of the laws of the various States on subjects which common sense indicates should be uniform, but the American Bar Association twenty-five years ago gave birth, through its committee on uniform State laws, to a separate body, a body composed of the official representatives of the States, appointed by the Governors of the States to devote their time and energies and what capacity they have—let me say, in parentheses, without compensation—to the unification of the laws of the States on matters of interstate interest. It so happens that I have been for some years the representative of the State of New York in the general national body which is called the Conference of Commissioners on Uniform State Laws. We have taken hold of many subjects, ranging from marriage and divorce to the subject which was referred to by the last speaker, warehouse receipts. Our uniform negotiable instruments act, for example, has been enacted in every State, territory and federal district of this country except one. I mention that simply to demonstrate that the thing can be done, because it has been done. Now it only remains for me to say that the committee of the American Bar Association on uniform State laws and the Conference of Commissioners on uniform State laws will be very glad indeed to coöperate with your committee to secure, as far as may be, uniform laws on this subject of road building, road maintenance and road legislation and regulation and all the incidents which go to make up the details of this movement which is so powerfully backed and so powerfully carried forward today as illustrated by this convention. Thank you, Mr. Chairman and Gentlemen.

(Mr. Pennybacker's motion was then unanimously adopted.)

THE CHAIRMAN: Mr. Kenyon, the President of the Indiana Road Association has given great thought to the subject of road legislation, and I am sure will interest you.

ADDRESS BY CLARENCE A. KENYON

President Indiana Road Association

I had no expectation of being called upon, but road legislation is a matter that I am very much interested in and I am sure that you are, and that anything I might say that would be in the nature of information or suggestion that will help you, will help the cause. If this commission has or will recommend a bill or a series of bills that they can send to the various States recommending such bills

as legislation that would be suitable for the various States, I am sure that we will be very glad to receive it in Indiana. I was recently in London attending the International Road Congress. There were thirty-nine countries of the world represented there. Everyone was asking what are we going to do with our roads, they are wearing out, what kind of legislation shall we enact, and what kind of construction shall we adopt? What is the best? And so this great congress of experts, consisting of over three thousand members, were devoting their attention to these questions. I will give you an idea of how they proceeded. They started out months before the congress met, and said to each country, "Select your best man upon the matter of legislation or organization for roads as well as on other road questions, and let him submit a paper;" these papers were sent in and translated into the three languages that would be used. All the papers on any one subject were given over to a reporter or a series of reporters, to go through them, and report what was the consensus of opinion from those papers. Those conclusions were then presented to the congress and were open for acceptance, amendment or rejection. This one question of organization and legislation took more time and attention of that big congress than almost all the rest of the questions put together. The engineers could solve the question of construction, material and maintenance, in a way, but when it came up to the question of organization, laws, the raising of money to pay for roads and so on, they were at sea. Some thought one way, some thought another, just as we here, as was apparent this morning. Here is Mr. Shackelford with one idea, here is Mr. Borland with another idea, and when we were at Washington two or three years ago we found sixty-two bills in Congress on national aid, each with a different idea. To get the minds of the people concentrated on any particular plan seems to be difficult, so in each State we have the same trouble, and I think if this committee that these gentlemen are working with, can outline a law or laws that they can recommend as uniform for all the States, it will be very acceptable, and the quicker the better. One principle that I might say, they were united on over there in Europe was this first, that the unit of organization should be large enough, in every instance, to properly finance a road and provide for an adequate staff of expert men to properly construct and maintain it. The very statement of it seems to be true, doesn't it? All the laws should be built upon that idea. The next proposition was, that no road should be built where there was none needed, and, as a corollary to that, no roads should be built that costs more than the necessities of the road demand, and as a part of that same thing, this proposition, that no road should be constructed when the unit can not afford to construct it well enough, to bear the traffic that is going to pass over the road without excessive maintenance charges. These seem to be very simple things, don't they? They appeal to everyone as being true, and yet, are

we in this country, not building thousands of miles of road just simply because of its cheapness, \$1500 a mile, and \$2000 a mile roads, that will be destroyed in a few years, before the bonds, that are issued to pay for them, are paid. Why, in Indiana, where we have the idea of extreme localization, each township has the power of issuing bonds to build roads. The county cannot issue a single bond or appropriate any money to build a road, the State cannot issue a single bond or appropriate any money for building a road, under our law, so that every road that is built must be paid for by the township. The large cities are exempt. See what it has done. Take the little county of Park over in the western part of the State; I think the largest place in it is the county seat, Rockville, which has about 4500 people, and yet they have over 650 miles of roads that have been built, and paid for by mortgage and bond issue running from ten to twenty years against the land in the townships of that county. They don't need all that road, built at the cost it was built, any more than a dog needs two tails. In my opinion they could get along with very much less road; in other words, they violated one of the cardinal principles that the London congress adopted which I was speaking about a minute ago; they had the very small unit of organization, a township. The unit was so small that they had to look to the casual man that was elected as road supervisor, or county commissioner every two or four years, to administer it. How could they get an adequate force of experts, or how could they properly and economically finance with those small units? They can not do it. They have issued the bonds, and do not properly keep up the roads. The result is that the roads are being destroyed, and before those bonds are all paid, the roads will be worn out. A demand for new roads comes along, and they cannot issue any more bonds, because the bonds issued for those that have been destroyed, have not been paid. That is the difficulty we meet with in this country, so I say we will hail with a great deal of delight and pleasure the report of a committee that will recommend such laws for general adoption by the States as will answer these problems. If we follow the idea, that a road should be so well built that it will answer the demands of the traffic that may be put upon it we will get somewhere. I saw an instance in England; there was a road running down in Shrewsbury, which had a very enthusiastic local community, a very competent civil engineer; those people wanted the road maintained; it was merely a macadam road; it cost \$750 per mile per annum to maintain that road, and yet those people permitted themselves to be taxed sufficiently to maintain that road, rather than not have it. They wanted the autobus service that a farmer had started where the people could pay as you do in a street car, and ride backwards and forward through that county. Of course there was plenty of land in that county, that is not anywhere near the road, but still they could go a mile or two to the road and then go a long way by just getting

into an autobus, for 5 or 10 cents. On another road running to Maidenhead, another engineer, than whom they said there was none more competent, as engineers go, but who had the advantage of a larger unit, a general road board. He said there was no use doing the uneconomical thing of trying to maintain the road at the big cost of \$500 to \$700 a mile, we must reconstruct the road and put a surface on that will be adequate. They followed his advice and did it, and the general road board, like the national government, contributed to the construction of that road. After the road was finished, they found it was only costing £5 or \$25 per mile per annum to keep it up, instead of \$750 a mile. That is the thing I say we need in this country. We must balance the cost against the maintenance, to make the road economical to maintain, and our system of administration should be so timed, that the tax is properly and equitably distributed, then you will find the people in this country just as enthusiastic, patriotic and anxious to have good roads and willing to pay for them as they are in England or any other country. I think this conveys the idea that I have upon this subject, and I again repeat that we, in Indiana, will certainly welcome the report of the committee, and I hope we will get copies of it at the very earliest date possible. Let me tell you another thing: just for a moment; many of you are not from Indiana and don't have the troubles we have there. We have 92 counties and 1017 townships in the State, which has an area of 35,000 square miles, in round numbers. Can you think it possible that, with that area, we would have 6500 road officers, men concerned with the building and maintenance of roads? Well, we have. It does not seem possible that you could get such a force in our country that would be competent. You know we could not. We haven't, and yet they are men that are anxious and willing to do their duty, but they don't know; the unit of administration is so small, that it cannot be properly financed and they get no aid from the State, and while they get aid from the county in the way of maintenance, they get no aid from the county in the way of construction. Here are three commissioners from each county—92 counties, 276 officials right there, then there's 92 county surveyors, and the county surveyor does not have to have any other qualifications than merely being a voter and a citizen of the county. I have known drug clerks and men working in a hardware store to be elected county surveyors. The unit of administration is so small that you do not get competent men, you do not get the thing that the London Congress was insisting upon, a competent staff. Then each county divides their roads, they call them improved roads, up into districts and allows the county commissioners to employ a man for each 10 miles of road, as a sort of a foreman to look after them in the spring and fall, and then we have this 1017 townships with one trustee for each township; each township then can have from two to six supervisors, according to the size of the township; there are 2500 of them.

They get \$2 a day for sixty days, there's \$120 each, imagine the large sum paid out in salaries to this 6500 men over the State. Can you imagine them as a competent staff? There's no direction, no head, no harmonizing of effort, and such are the troubles we have in Indiana, and I have no doubt to a lesser extent they have that same trouble in other places, and when I told that to the London Road Congress, there was just one shout of "Ha! Ha! can that be possible?" No country in the world has any such extreme localization as we have in Indiana and I hope no other States have, so you see the necessity of wiser laws. Give us the report of the committee. Gentlemen, I thank you.

CONSTRUCTION AND MAINTENANCE SESSION

October 1, 10 a.m.

A. N. JOHNSON, Chairman

THE CHAIRMAN: Gentlemen, come to order, please. We regret that we received a telegram from Colonel Stevens stating that he will be unable to be here, and Mr. Page asked me to preside in Colonel Stevens's place. I understand that most of you have received copies of the papers. If you have not, copies will be furnished to those who desire them. Owing to the fullness of the program and the limited time, it seems desirable to make some definite provision as to the time to be consumed by each speaker. We will allow the authors of the papers five minutes in which to summarize and explain their respective papers. The gentleman who makes the opening discussion will be allowed ten minutes and two minutes discussion from the floor, and I will ask all of you to please observe these rules. The first paper on the program is by Mr. W. S. Keller, State highway engineer of Alabama, entitled "Unsurfaced Roads." Mr. Keller.

UNSURFACED ROADS

BY W. S. KELLER

State Highway Engineer of Alabama

When I was notified by the secretary that I was expected to present a paper to this Convention on the subject of "Unsurfaced Roads," I was considerably worried for the reason that I read a paper at the Convention at Atlantic City last year on earth roads. Now, the difference between earth roads and unsurfaced roads is about the same as the difference between Tweedledee and Tweedledum, so I have had to infringe to a certain extent on my paper of last year in the preparation of a paper for this year and I hope those of you who have read that paper will forgive me for repeating to a very great extent what was said in that article. I believe all engineers are prone to build high class roads. We all like to see a finished product. In our efforts to build these roads, we are inclined to overlook the little man, the man who has an earth road leading to his home and will, perhaps, never have other than an earth road, so my paper is particularly appealing to you in behalf of the minor class road. Now, in our efforts to build earth roads, the main work we have to do in the South is to locate our roads. Our roads

have never been located. We are still following in many places, the trails that were laid out by Andrew Jackson and even the trails that were made during the Civil War by the armies that marched through the States. The trails, of course, were made wherever the armies could get through. They avoided marshes that possibly could have been filled over; they made long detours where, perhaps, by a little work, a shorter course could have been found.

I was reminded by the chairman that I have only five minutes to discuss my paper. That is a right hard thing to do, to know just what particular feature of a paper you have written you want to discuss, so I don't know anything better than to say it is with you and I hope you will bear in mind that I am writing from an Alabamian's standpoint, from a Southerner's standpoint, you might say, about earth roads in Alabama. I do not propose to tell you what the earth roads of Michigan, New York and other Northern States are, because I am not familiar with them, but I am writing of the construction and maintenance of earth roads in the South. Now, we all know that the greatest thing we can do to maintain earth roads is to constantly use the drag. The greatest trouble we have in the South is convincing our commissioners that the drag is of value; it is too simple. I have often said that if a drag was manufactured and beautifully painted by some machinery concern just exactly like the old wooden drag with a great big name on it, manufactured by "Blank Company" and \$50 charged for it, commissioners would buy them and use them freely, but because they can make them in their own barnyard, they don't believe what you tell them. We have got fine results in some sections of our State by the use of the drag, but I do not believe the drag will do everything. I do not believe it will grade a road or remove stumps or remove rocks, as some over-zealous advocates claim, but I do believe we can do wonders if we properly locate and grade the earth roads and keep the drag on them. I know we can do it in the South because we do not have the heavy freezes that you have and we can keep our roads in splendid condition if we will only adopt and use it, but we must keep on using it. I am reminded of a story, in connection with this, of a young lady who wrote to Laura Jean Libbey. You know Laura Jean Libbey answers lovesick girls and boys and gives them good advice. She wrote, "I am engaged to be married to a telegraph operator, have been for some time; he lives near where I do and we live about a mile from the depot; during the afternoons of the summer, I have been in the habit of walking with him to his place of business through a skirt of woods. Now fall has come on and it is rather late as we walk to the depot and I am afraid that I will be criticized by people who are inclined to criticize me for walking through the woods with my intended husband. I want to know if it is entirely proper for me to walk through the woods with my intended husband?" Miss Libbey answered: "I have received your letter asking my opinion as to whether it is

proper to walk to the depot with your intended husband and I want to say to you that it is all right to walk to the depot with your intended husband, but keep on walking." I say to you we will have to keep on working our earth roads if we are going to keep them in condition.

There are 2,100,000 miles of roads in the United States that are unsurfaced or rather have not been resurfaced by the hand of man. It would be difficult to ascertain the various soils or natural earths composing the wearing surface of unsurfaced roads. From the finest silt to the hardest granite these roads are composed of and the treatment of one will entirely differ from the treatment of the other.

Until within recent years it was considered next to impossible to make a good road of ordinary earth without surfacing with stone, gravel or other hard material. The absence of suitable material in vast sections of the country and the high cost of it when handled by railroads has forced attention to earth or unsurfaced roads. Unsurfaced roads may be divided into three classes:

First, the ordinary country road opened when this country was young, leading from one settlement to another or from a farmer's home to that of his nearest neighbor. These roads were not opened through any process of law, in fact, there was no law governing roads in those early days, but by following trails of least resistance, removing trees and such rocks as would not permit the axles of wagons to clear, the pioneers of this country made it possible to travel, in a way, from place to place. We have many roads in Alabama now in use that were opened and traveled by General Andrew Jackson, both on his march to fight the British at New Orleans and the Indians in south Alabama and Florida. Of course, such roads were opened hurriedly and little or no attention was given to grades or alignments. Settlers taking advantage of work that had been done built their homes along these military roads or traces as they are frequently called. In the construction now of more modern roads, it is difficult to better the alignment of these roads on account of homes, churches and schools which have been built close to these highways. However, in many places, these roads have been and are being changed to meet the demand of traffic of today. The genuine bad roads of the South belong solely to this class. They cannot be maintained for the reason that they have never been constructed and the great amount of work necessary to keep them in passable condition disheartens the man who by law is compelled to work them. Until these roads are relocated, avoiding heavy grades and marshy bottoms, sharp angles and useless twists and graded so that they will have good drainage, we may expect them to be bad.

The second class of unsurfaced roads are the ordinary graded earth roads which have proper alignment, grade and drainage. The construction of an earth road is simple, but sometimes the simplicity of it causes the average county commissioner or supervisor to overestimate his ability as a road builder. The proper construction of an earth road consists of:

First—A careful inspection by the proper official to determine what beneficial changes in grade and alignment can be made, taking into consideration initial cost and cost of maintenance. The center line and grade of the road should be established by an engineer. After the center line has been established and width of road bed agreed on and grade established, construction work can begin. The proper and efficient grading force for the work should consist of a foreman, eight or ten good two-horse teams with drivers, one wheel and one drag scraper for each team and one extra wheeler and drag for emergencies, one good railroad grading plow, one grading machine, one split-log drag, one dump man and one loader with five or six extra men for grubbing and other work. The foreman should be an experienced grading man who understands handling earth and knows when it is proper to use drag scrapers, wheel scrapers or wagons. The road should be so graded that the ditches or gutters are parallel with the center line of the road and uniform distance from it. When completed the road should be uniform in width and surface should be smooth and even, free from holes and high places with a uniform crown with a fall of 1 inch to 1 foot from center to gutters. On grades this ratio of fall should exceed that of the grade to such an extent that water will readily flow to the ditches instead of down the road. Drain pipe should be freely used and no water should be allowed to flow over the road if it can be avoided. In some cases it is not practical to build the road above high water. In such cases danger signs should be posted showing at what stage the water becomes too high to ford the stream.

We have in the South nearly every kind of soil from sticky gumbo on the one hand to coarse sand on the other. The methods used for improvement of roads through a section of one will not do altogether for the other. The worst roads by far that we have in the South are in our rich and fertile prairie lands, where, unfortunately, there is very little road building material to be found. This soil readily absorbs water and becomes very sticky after rains. It expands freely and dries rapidly when the sun shines and becomes very hard under the tamping effect of teams and vehicles. From observation and experience I have learned that these roads of all others require a very high crown and the driving surface should only be wide enough to allow two vehicles to pass. If a road is narrow with a fall of not less than $1\frac{1}{2}$ inches to the foot, water will shed rapidly to the ditches and the entire surface will dry out rapidly. A road of this kind can be constructed quickly and at little expense, except where grades are to be reduced or bottoms filled with a grading machine, or even with a split-log drag. The latter method will require more time, but in the end will be found to be very satisfactory. No earth road can be maintained in good condition unless it is so constructed as to drain well and unless it is kept free from ruts and holes.

The third class of unsurfaced road which we frequently have to deal with are those in sections of country where the soil or earth is really road building material, composed either of gravel, sand-clay or

top soil so that when the road is graded it is, in fact, surfaced. Where this condition exists, splendid roads can be built at a minimum cost.

The maintenance of unsurfaced roads is radically different from the maintenance of surfaced roads. For instance, the patrol system used on macadam roads would be entirely inadequate for earth roads. One man can keep up 2 or 3 miles of macadam road where he would unquestionably be unable to keep in good condition a like amount of unsurfaced road. With the use, however, of a team and drag, he would be able to keep in good condition 20 miles of ordinary graded earth road. Some very zealous advocates of the drag claim everything for it, from the removal of stumps and rocks to the ditching of roads. I am a great believer in the drag, but from experience, I know that obstructions must be removed and proper drainage provided for before it is effective. It has been difficult with the road men of the South to convince county authorities that this little machine is of value. The writer when in charge of road work in a Tennessee County inaugurated a system of dragging that proved very successful. Ten roads were graded a distance of 3 miles each. The grading was completed in November. With surface of these roads fresh and loose, it was a foregone conclusion that the winter rains would soften them to the extent that they would become impassable under heavy traffic. Contracts were made with a farmer on each of these roads to keep them dragged during the months of December, January, February and March and the price paid was 30 cents an hour for a man and team. The county furnished the drags. As an inducement to the men to do good work, the county offered prizes of \$25, \$15 and \$10 for the best kept roads. Specifications for dragging and rules governing the contest were furnished each contestant. One important rule was that the prizes would be awarded to the men who kept their roads in the best condition at the least cost. In order that the engineer might keep in close touch with the work, postal report cards were furnished each man and they were required to fill them out every Monday showing the distance dragged, hours consumed and cost for the previous week and mail them to the office of the engineer. In this way it was practically impossible for a dishonest man to render an account for more time than he really consumed without it being detected or if he worked more than was necessary, the reports of the other contestants when compared with his disclosed it. On the other hand if one should be neglecting his work by not dragging sufficiently it was likewise detected. This 30 miles of road was kept in splendid condition despite the fact that two heavy snows fell during the four months. The most interesting fact connected with the contest was the road that was awarded first prize cost the county only \$15 or \$5 per mile.

In many southern States the roads are maintained or at least are supposed to be, by what is known as statute labor, which means a man subject to road tax may work out his tax under the direction of a beat or district overseer. Such labor is practically worthless and

few men are required to work out the stipulated number of days. As it seems to be impossible to entirely abolish statute labor, the question that confronts us now is, what is the best system coupled with this labor to use in the maintenance of our roads. Good results have been accomplished in several counties in Alabama by putting the work in the hands of a few regularly employed foremen who give all of their time and attention to the work, instead of leaving it to many beat overseers who work when it suits their convenience, or do not work at all when it suits them, as it usually does. These foremen are furnished with two or three teams with regular drivers, wagons, scrapers and grading machines, split-log drag and necessary small tools and as many beats or districts assigned to each as he can work. A census is taken in each foreman's territory at the first of the year of all men subject to road duty and he is furnished with a list of names and is required to work every man who has not paid the required amount of cash into the county treasury in lieu thereof. No foreman is allowed, under penalty of dismissal, to receive cash from work hands, but such hands as desire to pay must make their payments to the proper county official at the court house. This method has proven good in most cases, but as a general thing I do not think the best results can be accomplished by permitting men to work out their road tax.

In conclusion I desire to urge that in your effort to better rural conditions by the construction of the main thoroughfares with hard surfacing material, that the branch roads and "side-tracks" be not entirely overlooked.

THE CHAIRMAN: The discussion of this paper will be opened by Mr. George W. Cooley, State highway engineer of Minnesota. Mr. Cooley.

MR. COOLEY: Mr. Keller has treated the subject of unsurfaced roads so generously, even though he had to draw on the previous report, that there doesn't seem to be anything to criticize. I would like, however, to add to the statements he has made in his paper by quoting something from the laws of the State of Minnesota. You know, just as well as I do, that 95 per cent of the roads in this country that will be in use for the next twenty or twenty-five years are the common, ordinary earth roads, and that is the problem before the people of the South and the people of the West. There are two or three questions involved in the construction, or maintenance rather, of earth roads; first, location, then construction, then maintenance. We will assume that the essential part of the work has already been taken care of, drainage and all that sort of thing. The first point of importance is the question of location, and that came to me very forcibly a few years ago when I was riding over the western part of the State of Minnesota with a friend of mine and we came to a road that seemed to be crooked without any reason for crooks, and

I said, "I wonder what crazy fool located this road?" And he remarked, "He is riding now in the buggy with me." And it appears that that road was developed from the original trail made by me when I used to send my teams back from the prairie camp to the timber to get wood, and as soon as the farmers came into that country, they took this trail because it was the only one to the timber. Gradually it became a country road and now that road has developed into a very important State highway. So it is very important that we should take care and see that the location is so well established and so carefully laid that we won't have reason to change it in three or four years, because that is one of the most important propositions we have in connection with earth roads, the proper location, the construction of the roads. I found in my experience that every man in the West and South that has ever had anything to do with roads knows more about them than anybody else. I found that they all had the best system of roads and understood the question better than anybody else, but in the construction of the common earth roads, one thing is insisted upon in the State of Minnesota, and that is the elimination of everything in the nature of perishable material. I have noticed in different parts of the States some of the good roads States particularly, where dumps are built up from sods placed on the side of the bank to prevent the wash of the slope. That is something we absolutely forbid. We aim to get the material of which our roads are built from the natural soil, discarding anything in the way of perishable material. A gentleman spoke yesterday about the great army of men who had charge of road construction in his State, I think about six thousand, but Minnesota can go that one or two better. We have about two thousand towns in our State; every one of those towns has a road overseer and three road supervisors, so we have altogether, including county commissioners and surveyors, an army of ten thousand men to look after our road business. That is the way it has been up to the present time. The legislature passed a law at the last session providing, among other things, for the abolition of the statute labor tax; we have abolished that and the system of road overseers, so that now, instead of having three overseers or four or sometimes ten or twenty in a town, we have just one. We have concentrated the authority in road construction in the following manner; towns appoint one road overseer who works under the direction of the assistant engineer. The assistant engineer is employed by the highway commissioner and works under the instruction of the State engineer and we have divided the State up into sixty districts and in those we have located the assistant engineer to look after all of the road construction and bridge construction in that district. Under him works the county superintendent of highways, when they have them, and the town road inspector, so we have a uniform system there by which we are achieving the very best results. We have another clause in our law that provides for a

tax of one mill on all the taxable property of the towns for the purpose of dragging; that can only be used for dragging purposes. Then we have in our law another clause which I consider of the greatest importance, with regard to the subject of maintenance; that is, we have a fund for distribution next year of a million dollars and a half, divided up among eighty-three counties. No county is receiving less than 1 per cent of that money, and 20 per cent of the total fund is supplied for maintenance; that is compulsory. The law provides a fund of over \$500,000 for the continuance and maintenance of our roads. As I said, there is nothing to criticize in Mr. Keller's paper and I thank you for your attention.

MR. CLARKSON (of Missouri): I did not expect for a moment to have anything to say with reference to unsurfaced roads, because I supposed there would be a number of other gentlemen who would take up this subject, but inasmuch as there doesn't seem to be any disposition on the part of the others to speak I wish to make one or two entries. The first entry I would make is that it is a subject of importance for the reason that this is the road that many of us have to travel and will have to travel as long as we live, and I believe that these conventions should give more importance to the unsurfaced roads than has been given in the past, because of that fact and because of another fact, which is that when too much attention is given to the surfaced or hard road, it has a tendency to discourage people who must build and must travel dirt roads from doing anything, because there seems to be no attention given to the unsurfaced road; so I feel that it is a fortunate thing that this subject is put on the program and trust that some importance may be given to it.

MR. HOWER (of Maine): As the gentleman has just said, unsurfaced roads or dirt roads are by far the most important we have to consider in this country, and I, for one, would like to see some uniform steps taken toward having better dirt roads. I believe myself that one of the greatest aids in making our dirt roads better roads—we cannot make them good roads—is to have a uniform law throughout our States compelling the use of the road drag. This subject of course has been brought up before, but I find in traveling over the country, that there are less roads not dragged than they are dragged, and there is no doubt to my mind that if the delegates here would take home the value of the drag in connection with dirt roads, that we would have better dirt roads throughout the whole country. I, for one, would like to see a resolution put through by this congress asking the various road commissioners, asking the various legislatures of our States to pass laws somewhat similar to that passed during the past year by the State of Iowa which compelled the dragging of dirt roads, and if it is not out of place, I would move that this convention, this congress, go on record as favoring road

drags and that we ask the committee that was appointed yesterday to take up the subject of uniform road laws for the various States, to incorporate this, if possible, in their report.

MR. CARPENTER (of Wyoming): I wish to say, Gentlemen of the Convention, that that is the one thing that impressed me all the time during the sessions of this Convention, that we are not paying enough attention to the matter of getting our dirt roads in shape. We cannot build hard roads everywhere. There are parts of this country where a dirt road, properly built and maintained, is as good a road as we want and as good as we can get for the next hundred years, even if we want a better road. It seems to me that the thing we are neglecting is the proper dragging of roads that must have a dirt surface, that we cannot get a hard surface on, that is, an artificial surface. It seems to me that we should lay more stress on wide tired wagon wheels, because you can put your roads in the very best possible condition, and after they are put in condition for the automobile, the heavy wagons with narrow tires will run over the road and cut it all to pieces. By using this drag and some means to keep the low places out so that the water won't stand in the road, I am speaking particularly of our Wyoming roads, by keeping that water from standing there, we keep the road good, while, if we leave low places so that a wide automobile tire runs through that water, the dirt is soft and it oozes out to the side and each time an automobile passes, the rut is made deeper. Until we can get hard roads over the United States, we should lay particular stress on this feature of having our roads properly drained and properly surfaced, worked with King drags or something of that sort. If we do that, we are going to have passable roads all over the country. If we do not, we will only have a few expensive roads constructed along some of the main thoroughfares from one city to another. Let us put more stress on that. I would like to hear suggestions; I would like for our engineers to take more interest in studying that feature. While that does not appeal particularly to the manufacturers of road machinery or the manufacturers of concrete and all those things, it does appeal to the man who has to run his automobile over the dirt roads of the United States.

MR. GASH (of Illinois): I was just going to make this suggestion, that I have heard a number of experts talk upon this question of the dirt road, and in addition they lay particular stress upon proper drainage and proper grading of the dirt road, but in addition to that, one of the greatest things you can do for the dirt roads is to work them at the proper season of the year. I daresay, as was said by a man in LaSalle township, in LaSalle County, Illinois, a few years ago when we dedicated a mile of concrete road, he said, "I have lived in this township fifty-two years, ever since I was born, and there has been enough work done on the roads of this township

to have paved them with gold if it had been properly applied." Now, the trouble has been in the past that they have worked the roads at convenient seasons for the farmer. We, in the State of Illinois, have established a tax to be paid and to work the roads at the proper seasons of the year and that is while the soil is wet; so that it forms a hard surface over the dirt roads, if you work the soil while it is wet. Every farmer in the land will tell you that he won't work his soil in the field and cultivate it while the soil is too wet. Why? Because it will become dry and hard and crisp when the dry season comes, but the trouble has been, like in LaSalle County, all over the land, that the roads have been worked when the soil was dry and when the rain comes, it all washed away and the work was destroyed. A proper working, a proper grading, a working at the proper season of the year and a proper grading will make better dirt roads all over the country in every soil of this land.

MR. MYERS (of Ohio): I would like to say a few words in reference to the maintenance of roads, both dirt roads and pikes. I am in favor of legislation that will require proper care in hauling during the springtime or at periods when the roads are soft. Narrow tired wagons and over-loaded wagons hauling, as they do in our county, large engines for the use of oil drilling and gas drilling, those injure our roads in one week or two weeks sufficiently to require adjustment throughout the entire balance of the year. It seems to me that there ought to be a law requiring broad tired wagons, and that this is the time when that should be taken up and considered very thoroughly. It seems to me further that the commissioners should be instructed or some move should be made by this association whereby the commissioners would do their duty in protecting roads that have been paid for by the farmers and others. We were very careless in Ohio and I daresay in other places, in allowing them to be destroyed because of non-attention to legislation or because there isn't legislation that will prevent them from being destroyed after they are made.

MR. SMITH (of New Jersey): I would like to call attention to this wide-tired wagon business; we are not paying enough attention to it. Some States have laws compelling wagons to have wide tires, others taking off the tax if they do have them. We need that more than anything else in the country. In England they have wide tires, the back wheels wider than the front, and you don't find a rut on the roads anywhere. There is no use spending thousands of dollars making good roads and then having them destroyed by narrow tires. The little narrow tired buggy of the farmer's son sometimes does more harm than an automobile. I want to urge that the convention take up this subject, because the time has come when we ought to have broad tires, and we ought to take the matter up and have a national law that will preserve the country roads and prevent their being destroyed as fast as they are made.

MR. STUCK (of Pennsylvania): In reference to the remarks of the gentleman from New Jersey—on the statute books of Pennsylvania we have a law requiring that wide tires shall be used. I happened to be very closely connected with the legislature at the time the bill was enacted, but, as all bills generally are, when it came to the question of a penalty, it was as good as no act at all. In Pennsylvania the roads are spoiled more by the narrow tire than by any other traffic we have got. If the tires were graduated in proportion to the loads carried, the dirt roads throughout the State would be in splendid condition. I would graduate them from the buggy tire up, and for each additional half ton or ton, I would add a proportionate size to the tire. I have seen five tons carried on a less than 4 inch tire. That wagon should have no less than 6 inch tire. I watch these things very closely, having been identified with roads for about fifteen years, and have worked them part of the time and seen our work partially destroyed by one wagon passing over the road.

THE CHAIRMAN: We shall have to bring this discussion to a close in order to finish our program, much as I dislike to do so, and proceed with the next subject, which is "Gravel Roads, Their Construction, Maintenance, Cost and Special Treatment," by Hon. S. Percy Hooker, State superintendent of highways of New Hampshire. Mr. Hooker.

GRAVEL ROADS, THEIR CONSTRUCTION, MAINTENANCE, COST AND SPECIAL TREATMENT

BY HON. S. PERCY HOOKER

State Superintendent of Highways of New Hampshire

What is the province of a gravel road? To what extent are they to be built. What is their economic value and how much credit should be given them as improved roads?

I know that the attitude of heads of departments in States where large sums are available is that of contemptuous indifference to the cheaper forms of road construction. In road building they are in the class of multi-millionaires, who smile contemptuously in their motor driven vehicles at the efforts of the country boy upon his bicycle.

Time was when I had the same view, when it seemed to me in looking over returns from various States that it was somewhat of a travesty to put gravel roads under the heading, improved. It is only a short time since I began to see that in certain localities and certain states they were almost imperative.

Where the mileage of a State was large and the assessed valuation small, I came to the conclusion that it was wiser to build this type of road than the more expensive ones.

In the evolution of thought I am now willing to go much farther and to say that no matter how rich the State, if it has a large mileage of roads, it is advantageous in many places to use this type of construction.

In the present, the people seeing the benefits of good roads, realizing the inconveniences of bad ones and fully comprehending that it is possible by the use of long term bonds to postpone the payment of such improvement, it is comparatively easy to procure large sums of money in any of the richer states.

Whose example are you going to follow, Mr. Commissioner, when a large sum of money becomes available?

Are you going to build a limited mileage of expensive road, where the cost of maintenance will run from \$800 to \$1000 a mile a year?

Is your bitumen bill for your road improvement during the year going to approximate in amount the total cost of your metal and your grading?

Are you going to be satisfied to resurface it at a cost of from \$1000 to \$5000 a mile?

Are you going to build such roads in sections where the cost of the road itself is five times the assessed valuation of all the land abutting on the roadway?

Are you going to place a bond debt which will approximate $1\frac{1}{2}$ to 2 per cent of the entire valuation of your State and then be satisfied with an improvement of one mile in five of your highways?

Will you be satisfied with a maintenance bill which entails from $1\frac{1}{2}$ to 2 mills per annum on your entire assessed valuation and then leave four-fifths of your highways unimproved and without any assistance from the State in maintaining?

This is in general the attitude of the State authorities who have sufficient money available to class them in the "Four Hundred" of road building.

From their point of view there is absolutely no value in a gravel roadway, so far as the State departments are concerned.

Where they can get the various towns, or counties, or boroughs, or whatever the unit of recognition may be, to build this class of road without expense to the State the "Four Hundred" may advise it, but it is contemptuously brushed aside as being of no value to the department. This attitude leads me to ask the question, what is the economic value of a gravel road?

I personally belong to the class of the meek and lowly. The class of which the Bible says, "The poor ye shall always have with ye," and it is an impossibility for the State which I represent to consider for a moment the question of average expenditure per mile of road, which is considered and accepted in many of the richer States.

We are obliged to turn to the cheaper class of roads and this necessity has changed my attitude as to the general proposition. I formerly had the same feeling that I know now maintains of the "big fellows," as to any talk about the use of gravel, unless the

gravel is mixed with such a volume of bitumen as to take it from the cheaper class and make it practically a bituminous road. I do so no longer.

No matter what the financial condition of the State, no matter how much money is available, I think there is a large per cent of the road mileage of the State that should be improved and maintained as earth or gravel roads.

When the initiative for the construction of a roadway lay with the local sub-division, town or county, the weakness of the law requiring this was shown by the lack of continuity and the short pieces of highway, or any through route, which were interspersed among the bad sections. The local interest called for sections which were no part of a continuous highway and it seemed that the State must select certain routes which practically must be paid for by the State or at any rate only a small percentage by the locality. This provision temporarily seemed to fit the situation. You had provided for ready access from one center of population to another, so that the tourist, who, through the advent of the motor vehicle was becoming a large factor in the road traffic, was able to travel upon an improved highway wherever he was likely to desire to.

Right at this point is where the executive heads of the departments failed to comprehend their opportunities for the general good. Here was the opportunity for estimating the value of the road as an economic proposition as compared with its value as a pleasure route. So far as I know, every executive confronted with this situation made the same error. They all failed to consider that a road which was practically little used except for the summer season could be made satisfactory during that season with an expenditure of only one-quarter of what would be necessary upon a road with heavy local traffic, which would be used as much in the spring and late fall months as in the summer.

Roads were built in thinly inhabited sections of the same class and quality as where the traffic was through a thickly inhabited section.

One-quarter of a million dollars was spent in a section of a certain State for building a highway, 95 per cent of the traffic on which was comprised within four months in summer. In another State a 2-mile section of road was built at a cost of not less than \$25,000, in the middle of a swamp 8 or 10 miles long and which was practically impassable to traffic.

From a casual inspection, I believe, to make it available over \$100,000 more would have to be expended and then on its entire length there were not more than ten residents. The local traffic on this road would not justify the expenditure of any State money. I do not believe that all the produce hauled over the road would sell for enough to pay the interest on its cost, leaving aside the cost of the maintenance of the road which I do not think could average less than \$500 per year, per mile.

The only justification for this road was through traffic and I personally think that had the amount of money expended on this

2 miles been spent on cheaper construction on the entire roadway it would have been an equally satisfactory road for tourists and the money necessary for the maintenance of the 2 miles would have kept up the entire 10 miles if built of the cheaper construction.

We all of us know that the automobile is the chief factor in the creation of the sentiment for good roads. We appreciate what they have done for the general system but among the automobilists themselves there is a constantly increasing demand for more roads which are satisfactory to drive upon and they are no longer satisfied with one route between two points. They must be able to go by one route and return by another. They do not want the sameness of continuously driving over one road. This being so, why not combine the desires and wishes of the local people, who wish to use the roads for business and of the autoists, who wish to use them for pleasure.

Had the heads of the highway departments at the time when the large sums of money began to be available adopted the policy of providing more miles of reasonably good road, rather than the limited mileage of the highest class road there would certainly have been little or no difficulty with the motor vehicle driver.

A road maintained so that it was a smooth, easy driving road would have fully satisfied him.

Have you educated him to the idea of such expensive roads that he will not be satisfied unless he gets them? This is a question I am unable to answer.

Build your road for the local and wheel traffic primarily, build it as expensively as you desire, build it substantially and then connect this piece of road with the next piece which requires the same sort of construction by the cheapest methods in which it may be satisfactorily maintained as a summer road.

A permanent highway in any place where your local traffic demands the high and expensive type of construction must be a pavement. It may be brick, it may be concrete, but it must of necessity be of a greater efficiency than most of the types of roadway, which we are now building.

The question of financing road building up to the present time has been largely a question of borrowing money enough upon long time obligations to complete the road, but we are rapidly approaching the point where, from the multitude of obligations assumed, the question will be, how can these obligations be paid, rather than how obtained.

My general conclusion, therefore, about gravel roads is that their economic value is such that four-fifths of all the road work of a State should consist of the class of roads, which we call—gravel.

I know the answer which so many department heads make to me. "You have gravel and can build such roads, but how are we to do so?"

When I use the word, gravel, I do not necessarily mean a combination of sand and water washed stone, which is commonly and generally considered as gravel. I mean any combination of material which contains not less than 60 per cent of metal, in shape and size

so that it need not be crushed, whether the binder be true sand, clay or marl.

If the binder is of the latter, it must contain a larger percentage of metal than if composed of either sand or clay. The question of gravel to me means that you have an aggregate containing stone which will from its own disintegration form a binder or one to which some material must be added which is adhesive in wet weather and in drying forms a covering or shell firmly binding the metal together.

I believe there are few localities east of the Mississippi River which do not contain large quantities of such material. The sandy gravel may be some little distance from the necessary clay binder but I believe within a reasonable distance it may be found, at least in all the eastern States.

CONSTRUCTION

Whatever road is built the fundamental proposition is the drainage. If you are building on a sand foundation, this is not so vital a point as where you have an impervious clay subsoil, but even with the sand the water must be provided with channels to keep your road dry or it may develop that the fine sand which in dry weather you were obliged to fairly plough through in wet weather may act as a sort of quick sand with as bad a bottom as that of a clay road.

The width of your road should be the same whether built of gravel or of bituminous macadam. The quality of your gravel, as I have said, may vary to a certain extent. You must determine from its character whether it needs an additional binder. In the run of most gravel pits there is a percentage of stone which is too large in size to use in the surfacing proper. This may be used as a foundation either on sand or in wet clay holes. It is really required under either of these conditions.

It is not as requisite to use a telford specification where the surfacing is to be of gravel as it is under a macadam but when these larger stones are used they should be laid with some regularity and telfordising. That is, brought up to a comparative grade. The same specifications as regards embankment and fill should be used as would be with the macadam or bituminous road, except that much less care need be used in shaping your shoulders prior to putting on the gravel. If your gravel pit is particularly "bony" it may be necessary to screen the same but except for the top surface I do not consider it usually imperative. Stone up to the size of 3 inches in diameter may be used in the bottom course.

The road should be graded so that your final cross section will show an inch to the foot grade from your ditch line. Two methods are perfectly practical and in general use in starting the construction. One is to build the shoulders of other material and place the gravel so that when rolled it is 8 inches in depth over the metalled surface of the road. The sub-grade of the metalled surface will then be same as final section, 1 inch to the foot.

I prefer to leave the rough grading on a section showing 3 inches rise on $10\frac{1}{2}$ feet, as the roads we build are largely 21-foot roads, and the gravel showing $10\frac{1}{2}$ inches in the center and 3 inches on the outside edge of the road. This reduces the average thickness of your road on the metal part but gives a gravel shoulder which is invaluable in the maintenance. It also gives the 5 feet in the center, upon which the major portion of the travel always is, a depth of about 10 inches, instead of 8. In the maintenance, also, it prevents the growing of grass on the shoulders and makes the effect of the road much better.

The gravel should be laid in two courses. This is especially necessary on the first section spoken of in order to get proper compaction, though in the second section it is not so imperative provided the gravel is self binding and is all shovelled over on a dumping board or the load dumped far enough ahead of the work so that it must needs be completely forked and shovelled over. Where laid in one course it is very easy to spread the gravel so that the larger stones are all in the bottom of the road, keeping ahead of the work in this way and leaving the surface composed of your finer material.

If a binder is to be used consisting of clay or marl you must lay in two courses besides the binder or an equivalent of three courses as the bottom course of about six inches loose should be covered with an inch or so of your clay and then a top course applied.

Sometimes it is possible by the use of a harrow to work this clay course thoroughly through the top surface and where this can be done it should be. In practical construction it sometimes works out better to have your bottom course somewhat thicker and your top course somewhat less with the clay binder in between.

The adjustment as to the amount of the clay is largely a matter of experience. No exact rule can be given as to the amount of clay to be used, but a man familiar with the building of roads can usually tell in most cases how much is necessary to thoroughly bind it.

When there is water available and the road can be kept wet before being rolled it is easier to adjust the quantities. It must be remembered, however, that sprinkling the road in many places is an expensive proposition and as the whole theory is to obtain a road which shall be built at a small cost it is frequently possible to obtain rain enough on the road so that it may be built without the use of the sprinkler.

This summer has been extremely dry and it has been very difficult without the use of additional water to compact the road sufficiently. For a considerable time after completion the roads upon which no water has been used have failed to "come together." I find, however, that a good soaking rain will in many instances allow a considerable section of soft road to compact very readily and where the water for wetting the road must be drawn a long distance it is practically wiser to build the road without such water.

You will understand that I am talking the gravel road as a cheap road and that anything that tends to make it approximate in cost, a broken stone road is to be avoided.

The quantity of gravel which is used in the construction of these two types of gravel road figures as 37.04 yards per 100 feet compacted which will require from 42 to 45 yards of loose gravel in building a one course road and something more in a two course, the amount necessary to haul upon the road depending to a considerable extent on the quality and constituent parts.

COST

The cost of gravel roads will vary to a greater degree than that of either bituminous or water bound macadam. The reason is that the actual cost of your material in the higher types of construction is fixed, while in the gravel road the cost in the pit compared to the cost in the furnished roadway is almost negligible.

The price of your gravel may be only 5 cents per cubic yard and its cost is fixed by the average haul. With the material situated on or very near your roadway the cost of your gravel construction may not exceed from \$1600 to \$2000 a mile, while with the material compelling a 2-mile haul it may run up from \$3000 to \$3500.

Assuming that your grading and drainage is upon an average \$1200 per mile, you have your total cost of the road per mile running from \$2800 to \$4800. The average of all the gravel roads built, in the State which I now represent, has approximated \$3900, including the grading.

It must be remembered, however, that a considerable per cent of these roads are in sections absolutely remote from any railroad facilities and the cost of the more expensive class of road would be far higher than the average in states where the railroad facilities are better.

For instance, in one town, where we are building, the railroad station is about 40 miles and the cost of delivering bituminous material upon that road would be almost as much as the cost of the material itself at the railroad station.

The rock in this particular town, while available in quantity all along the road is of such a quality that in crushing the native stone you would practically procure 50 per cent of unavailable dust to say nothing of the probability that under a roller your grades of stone would crush down into dust. I do not think that a bituminous road with imported stone could be built for less than \$30,000 a mile in this particular town through which one of our trunk lines runs and 95 per cent of the traffic is summer traffic. The total population of the town is only 211 people and the total mileage of our trunk line through the town is 13 miles.

This 13-mile road when finished will not cost to exceed \$40,000. Would the heads of departments who look with supercilious scorn at

calling gravel roads, improved roads, think that the expenditure for other types of roads was warranted?

SPECIAL TREATMENT

From my point of view when the ferment for good roads, that is now agitating the road builders and the general public has subsided and the resultant wine has been carefully quaffed there will be little or no special treatment for gravel roads. The road will be kept as a gravel road with no masquerading as a different type. It will only be used in sections where the dust nuisance is not intolerable and the attempt by treating the road to make it an actual competitor of its higher priced neighbors will cease.

I do not believe that it is possible to convert a cheap road into an actual competitor of pavement by any treatment. Two forms of such treatment have been experimented with with more or less success.

Naturally with the coming of bituminous roads of the macadam class it was hoped that by the use of the same bituminous materials equally as good results might be obtained on gravel roads.

It was soon evident, however, that very little was saved by the attempt to use gravel in place of crushed stone in combination with bitumen. In order to make a satisfactory aggregate the gravel must be screened into several sizes and the natural binder must be eliminated.

The cost of handling the gravel and combining it in proper proportion was such that there was no lesser cost than in using macadam. The roads as a whole were not as satisfactory for two or three reasons.

First, it was almost impossible to get your aggregate clean enough so that the substituted binder in the way of bitumen adhered closely to your metal. The metal used was without clean cut breaks and fractures and did not as readily ally itself with the bitumen.

In certain cases where a clean sandy gravel could be obtained there were good results so far as the construction of the road was concerned but little saved in cost.

Naturally the next step was to attempt to apply the blanket treatment, using the bitumen on top of a gravel road. I think one of the faults of this treatment is that the untreated road if constructed properly contains the same native binder, which interferes with the construction of a bituminous road. This treatment, has in many instances, been a satisfactory one. I think it is impractical to treat with as heavy an oil or tar as can be used on a macadam road but the bitumen known generally as from 50 to 60 per cent class, applied hot and requiring a cover, in many instances proves satisfactory.

There is a tendency, however, upon these roads to develop holes and pockets, arising probably from the fact that a gravel road is not a homogeneous one but is of itself composed of the metal, not properly distributed, mixed with a fine aggregate which we generally know as sand.

There seems to be a peculiar failing of these roads from the fact that when the crust which you have applied is broken it rapidly disintegrates around the hole. There is only one method of treating such a hole. It must be immediately attended to by the patrolman with a combination of bitumen and gravel or in other words it must be "patched." By immediate attention, if the holes as they appear are filled there need not be any considerable added charge to your maintenance.

One great objection to this form of treatment is, however, that it is impossible to use the road drag and bring your road back into section as you do on the untreated gravel road. The distinct tendency of a gravel road is to flatten and get out of section much more rapidly than a macadam road and unless you continuously and after every rain bring this road back to section it is not a satisfactory road. The chief objection is that you are adding materially to the cost of maintenance as it will cost not less than \$400 per mile in addition to the patrol charge which will of itself be fully as large as an untreated road.

Variations of this same idea of surface treatment are made by the application of light oils and tars which can be applied cold and without the addition of farther material. In some instances these seem to be effective and satisfactory. The surface after application and under automobile traffic has in certain cases "rolled out" so that you have a fair imitation of an asphalt road, particularly in the wheel tracks.

The tendency is, however, that where there is considerable horse traffic the action of the horses hoof tends to "meal up" the road.

I have not been able to analyze for myself the exact reason for the difference in result on these roads, but in most instances I think that the lighter oils on gravel roads only act as dust alleviators. The cost is cheaper than the other treatment and where there are a large number of people living along the road it is imperative that something be done to render life liveable and the dust held down in some manner.

On my general plan, however, of building gravel roads only where the local traffic of itself would not require a better class of road, I should have comparatively few residences on a gravel road.

The only other form of special treatment that I have used is with the by-product of certain pulp mills. This is claimed to have a chemical effect which makes practically a monolithic stone of a gravel road. I have had little experience with this treatment. I have in mind two roads, one of which is apparently a perfect success and the other, I believe, to be practically valueless, and not as good as though the product had been omitted.

Were this treatment uniformly successful, however, the added cost would be such as to bring it in the high cost class, rather than the cheap gravel road. The use of the heavy oils or this treatment may be valuable on a class of road which lies between the class

indicated for a permanent pavement and the summer road with a cost between the two but I think that the safer way at present would be to give the pavement the benefit of the doubt and use your sand and gravel in concrete construction and thus be sure that you had anticipated the future building.

In this talk about special treatment I have used one or the other of these methods for a large number of miles of gravel road and the question might well be asked, why if you use it do you not recommend it? My answer is that the gravel roads, which are thus treated are in sections upon which I do not consider the gravel construction advisable. They are in localities which have a considerable amount of local traffic. A pavement of some sort is evidently required in many of these sections but the gravel road is there and we have not had money enough to replace it with a pavement. It is, therefore, unquestionably necessary that we do the best we can towards making the roads so treated take the place, so far as possible, of the better type of road, which should have been built in the first place.

MAINTENANCE

A year ago at this convention I talked for some time on the question of the maintenance of gravel roads. Another year's experience has confirmed my statement that, under the patrol system, a gravel road could be maintained in excellent condition at a cost of not more than 25 per cent of the cost of the maintenance of the higher types of road.

This last summer has been an extremely dry one, the precipitation being only three-fifths the normal in New Hampshire. In the construction of gravel roads the lack of moisture is a very serious thing, and I must concede that throughout the summer this class of roads, as a whole, has not been in perfectly satisfactory condition.

This is especially true where the material used contains an added binder and will not of itself bind it. Where clay or marl was used as such a binder and no rain fell for a period of five or six weeks the tendency of the binder to pulverize and become a very fine product on the surface of the road resulted in the loss of a considerable per cent of this binder with a tendency to expose the metal in the top course. This was especially noticeable in a road which had considerable wear prior to this year where the finer particles of metal had been worn and somewhat disintegrated.

Notwithstanding this fact, the roads maintained under a patrol system were in comparatively satisfactory condition during the entire summer. The roads built during the summer, being absolutely new and not fully compacted before the summer traffic began, lack also the finish or coating which makes them ideal automobile highways.

The heavy rains recently have made it possible, however, to bring them into almost perfect shape by the use of the road drag, and I have no reason to doubt that next summer under proper maintenance they will be again the "ideal" motor roads.

Experience showing that constant patrol is absolutely necessary also confirmed my views that the patrol system of itself is not enough to properly maintain the highways.

I suggested that the ideal system of maintenance was by the use of a repair gang or a flying squadron who should do the preliminary work in the spring necessary to put the road in good condition before it was turned over to the patrolman for his exclusive care.

All the roads which were handled by this system early were maintained so that at this date they are in better condition than when the patrolman started the care of them in May.

On the contrary, the roads which were not in first class condition when the patrolman began work have required throughout the summer more or less extra repairing.

In practice, whenever the repair gang did not repair the road and wherever the patrolman was not able to show an improvement in his road I have authorized him to procure for a given number of days additional assistance. This adds somewhat to the cost of maintenance and in some instances we have not been able to secure good men for such temporary work.

In almost every case the assistants hired have no special knowledge of the work required and therefore are not as efficient as though they were regularly employed in a repair gang. Their efficiency depends almost entirely upon the patrolman. If he is not an extraordinarily good man his tendency is when his road is not entirely satisfactory to ask for farther assistance. He loses somewhat the pride which comes from having maintained his road by his own efforts in better condition than that of the adjacent patrolman.

The patrolman, himself, is the key to the system and you must awaken his pride as to the condition of his road in order to secure the greatest service. There is a vast difference in the capacity and the pride of the different patrolmen. As "Stars differ among themselves in magnitude," so do the patrolmen differ in their work. If upon him alone devolves the care of the road and its condition he works far better than with the feeling that you do not expect him alone and unaided to do the work. It is certainly advisable then to form a repair gang under a foreman whose duty it is to do the heavier work necessary on the road.

In practice we used the repair gang during the middle part of the season as an oiling gang, so that their work at the beginning and end of the season was repair work pure and simple, while during the larger part of the summer it was engaged in oiling.

Referring again to the subject which I have considered under "Special Treatment," wherever a gravel road has been previously built on a section of road which from the development of traffic has been shown to be inadequate. I have used the repair gang in the reconstruction of the road to make it of a different and higher type.

I do not think there is any better foundation for a semi-paved road than a worn gravel road. In building a bituminous top for

such a road the quantity of metal and bitumen to be used need not be more than two-thirds the amount required in ordinary building such construction and your foundation having "found itself" is much less likely to prove deficient in anyway.

This is a strong argument for the use of the gravel construction in cases where you are unable to determine which type of road is actually required. You may find that you require the pavement class where you have originally thought that the cheaper construction would do and if so, in changing the construction, you are not adding materially to the cost of the road when reconstructed and are thus able to correct an error without any additional expense.

I have not changed my mind in regard to the organization of a maintenance system. Starting with the "overhead" the division of the maintenance into units of about 100 miles in charge of an inspector, the sub-division into patrol lengths of from 6 to 8 miles in charge of the patrolman seems to me to be the only practical system.

I have not changed my mind as to the advisability of separating construction and maintenance, though I realize that the consensus of opinion is against such division. It is easy to say that any faults of construction developing after the completion of the road should be taken care of by the same man who superintends the construction. Practically, however, the "faults of construction" as compared to the wear of a road are infrequent.

The qualifications for an engineer of construction and for a superintendent of maintenance remain in my mind as diverse as ever. The construction period will in most instances not be exactly the same as the maintenance period. You can not expect that one man in charge of both construction and maintenance will have the same pride in the latter that the man who has sole charge of this will feel.

I have said nothing as yet as to the actual maintenance to be used on gravel roads as distinct from other types of construction. The special advantage consists in the adaptability of the road drag or hone to this work, the availability of the material for repair and the low cost of resurfacing. On a gravel road with material fairly available the cost of 4 or 5 inches of gravel upon the road will not exceed \$500 and with a patrolman on the road such resurfacing will not be required for eight to ten years after construction. The yearly resurfacing charge as distinct from patrol maintenance will only be \$50 or \$60 per mile, while the resurfacing of other types of roads will probably require at least ten times that amount. The patrol cost will not be more than \$100 per mile and the repair gang will not average over \$50, so that the total maintenance charge over a series of ten years will not be more than \$200 per mile.

Compare this with an estimate of from \$800 to \$1000 per mile and then compare the resultant road through the same period and it seems to me that the question as to the advantages of a gravel road has been answered.

I do not take myself seriously enough to suppose that a warning from me will change the attitude of anyone in regard to the building of highways in the respective States.

It is, however, in my opinion the greatest menace to the good roads movement that exists today. With the average cost of improved roads \$11,000 to \$15,000 a mile, with an average charge for interest on the investment of not less than \$600 per mile, with the maintenance estimated at \$800 per mile, when the day of reckoning comes and the small tax payer realizes the cost to him, how can you persuade him that economically he can afford to encourage the expenditure of such sums upon a limited mileage in each State?

He may never ride or drive upon an improved highway. He may still convey his produce to market over a road knee deep with mud in the spring time and yet he will be asked to add to his tax bill a sum which he figures approximates 2 mills for such highways. He is eventually going to ask, is it worth it?

The slogan of "Good Roads" has accomplished much. The demand "Better Roads" has made itself felt, but before the movement attains its culmination my impression is the cry will be, "More and Cheaper Roads," rather than either of those so prominently before the public.

THE CHAIRMAN: The discussion of this paper will be opened by Mr. Leonard Tufts, of Pinehurst, North Carolina, who will also explain his experience in the construction of sand clay roads. Mr. Tufts.

MR. TUFTS: There was a gentleman here from Maine who made the remark that you can make good roads of earth. Mr. Hooker says that the gravel roads are pretty good. For our section, in North Carolina, the earth roads are the best roads. But where they are the best roads, they are maintained and properly maintained.

Many think of a macadam road as a permanent road. The harder the surface, the more expensive a road is, as a rule, and the longer it will stand in good condition without attention. Eventually, however, it will have to have attention, and when this time comes, the expense of repairing is a great deal more than in the case of the softer materials.

The majority of people do not consider the sand clay top soil, gravel and earth roads good because they are seldom maintained. The dirt roads must receive attention every day in the year, whereas the harder roads can be left for a year or more and be fairly satisfactory. The cost of looking out for the dirt roads per mile is very small, but repairs must be made as soon as they are needed. The 250 miles of roads in my vicinity in North Carolina that Mr. McQueen my assistant, and I are maintaining, are not looked out for as well as they should be, because neither of us devote the time we should

to do this work properly. We probably do not devote more than a day a month to this work. At the same time the automobilists who come there frequently tell me that they are the best roads they ever drove a car over. One enthusiast from Massachusetts told me that one stretch of 30 miles was better than the Lynn boulevard. This particular stretch of road was built largely by contributions from people along the road and did not cost over \$9000 for the 30 miles, did not cost over \$300 a mile. The Lynn boulevard probably cost \$20,000 a mile.

Many of the roads are poorly located and the grades are too steep; they do not even look like roads, and, as some of the engineers here who have seen them will tell you, they exemplify everything that is bad in road construction. At the same time, there is so much good roads enthusiasm in our section that the road supervisors, although they have money in the treasury, never consent to build any roads unless the people will subscribe half the cost of building, and even with this stipulation the greatest difficulty we have in that section is to restrict construction of roads.

We have now in Mineral Springs township, between 40 and 50 miles of road and a road tax of 25 cents on \$100, which raises about \$2000 a year. From this you can see that the section is poor and is sparsely settled. Automobilists are well pleased with our roads; the farmers and the merchants of the section are proud and enthusiastic over them, because they are well maintained, and these roads are maintained at an expense of \$30 per mile a year.

There are thousands of miles of roads in the United States that can be made equally satisfactory, and I claim that greater attention should be given to this subject. With us, two men with a pair of mules are given a section of road varying from 20 to 30 miles. They keep the gutters clean, keep the bushes cut back, haul any surfacing material where necessary and drag the roads in their section after a rain and only after a rain.

Each of the farmers along the road who have two or more horses are given a road drag which costs us about \$2.50 a piece. We select one of these for about every 8 miles to attend to the dragging after a rain, and if the roads need it, these men are instructed to drag their section. If we find the roads need it badly and the regular man has not been attending to it, we telephone to another man that has a drag and ask him to drag it. Every time a man drags the road, he sends a bill to my office and receives a check for the labor of his team and himself. In some sections, we find it easy to get a man to drag; in others, there is considerable difficulty, but we are getting to look out more and more.

THE SAND-CLAY ROADS MAINTENANCE IN NORTH AND SOUTH CAROLINA

BY LEONARD TUFTS

No State in the United States can afford to have all roads macadamed or hard surfaced. I know that this is not the opinion of many road enthusiasts, but if you will look at the mileage of highways in each State and compare this with the taxable property in each State, and then consider the interest on the cost of these roads as well as the cost of maintaining them, I think you will agree with me that my first statement is correct. I find, from a bulletin published by the office of public roads this year, entitled "Repair and Maintenance of Highways," that the cost of repairs and maintenance of the State highways in Massachusetts in 1912 was \$676 a mile, and that the average cost of repairing and maintaining in Connecticut, Massachusetts, New Jersey, New York and Rhode Island for the last eight years was \$608 a mile, and even at this high cost the State highways in these States are not maintained as well as they should be. In the same pamphlet I find that the cost of maintenance in England, where labor is cheaper than here was \$415 a mile in 1910. In France the cost was \$347 in 1909. It is evident from these figures that the cost of maintaining a first class macadam highway in this country would be at least \$600 a mile. The taxable property divided by miles of road in Massachusetts and Rhode Island gives these States approximately \$250,000 of taxable property per mile of road. If the tax rate is 25 cents on \$100 this will raise \$625 a mile for all roads which is hardly enough to maintain them if they were all macadam, to say nothing of the interest on the investment, which would be at least \$300 a mile. If all of the roads in these two States were macadamed the interest on the investment and maintenance would necessitate a tax of 40 cents on \$100. New York State is next to Massachusetts and Rhode Island, and there they have about \$150,000 of taxable property per mile of road. There it would be necessary to have a tax rate of 60 cents per \$100. The other States have so little taxable property per mile of highways that it hardly seems possible to build any hard roads. Of course, if all of the roads in the different States were as fine as the roads in England and France there would be a great deal more taxable property, but I can hardly conceive of any State in the United States increasing its taxable property enough, with the exception possibly of Massachusetts, Rhode Island and New York to pay for the maintenance of their roads and interest charges. I think you will agree with me, therefore, that for years to come the roads in the United States, with few exceptions will necessarily be of some cheap construction.

I wish to make another statement. The average cost of repairing and maintaining a road is approximately 10 per cent of its original cost of surfacing. This figure is an average figure, and an approximate figure, but in my investigations it is surprising how often it comes out

right. From all that I can learn the surfacing of the State roads in Massachusetts, Connecticut, New York, New Jersey and Rhode Island, is \$6700 a mile; the average cost of maintaining—as I called to your attention before—is \$608 a mile, and if properly maintained would cost \$670. In North and South Carolina Mr. McQueen, my assistant, and myself have the maintaining of some 250 miles of gravel and sand-clay roads. These roads cost for surfacing approximately \$300 a mile. Labor is cheap and material is convenient. The cost of maintaining these roads is within a few cents of \$30 a mile. The cost of surfacing several gravel roads that I know of has been about \$1500 a mile; from all that I can learn, the cost of maintaining has been approximately \$150 a mile.

Many think of a macadam road as a permanent road. The harder the surface, the more expensive as a rule, and the longer it will stay in good condition without attention. Eventually, however, it will have to have attention and when this time comes the expense of repairing is a great deal more than for the road of softer material. The majority of people do not consider the sand clay, top soil, gravel and other dirt roads good because they are seldom maintained. These dirt roads must receive attention every day in the year, whereas the harder roads can be left for a year or more, and be fairly satisfactory. The cost of looking out for the dirt roads per mile is very small, but repairs must be made as soon as they are needed. The 250 miles of roads in the vicinity of Pinehurst, North Carolina, that Mr. McQueen and I are maintaining are not looked out for as well as they should be, because neither of us devotes the time that we should to the work; probably not more than one day a month. At the same time the automobilists who come to Pinehurst frequently tell me that they are the best roads that they have ever driven a car over. One enthusiast from Massachusetts told me that one stretch of 30 miles was better than the Lynn Boulevard. This particular stretch was built largely by contribution of the people along the road, and did not cost over \$9000. The Lynn Boulevard probably cost \$20,000 a mile. Many of the roads are poorly located; many of the grades are too steep—they do not even look like roads—and as some of the engineers here who have seen them will tell you, they exemplify everything that is bad in construction. At the same time there is so much good roads enthusiasm in our section that the road supervisors although they have money in their treasury never consent now to build any roads unless the people will subscribe half the cost of building, and even with this stipulation the great difficulty we have is to restrict the construction of roads. We have now in Mineral Springs Township between 40 and 50 miles of roads, and we have a road tax of 25 cents on \$100, which raises only about \$2000, a year. From this you can see that the section is a poor one and sparsely settled.

Automobilists are well pleased with our roads there. The farmers and merchants of the section are proud of and enthusiastic over the roads because they are well maintained. And these roads are main-

tained at an annual expense of \$30 a mile. There are hundreds of thousands of miles of roads in the United States that can be made equally satisfactory and I claim greater attention and greater study should be given to this subject by people who are interested in the road, than to the harder surfaces.

With us two men with a pair of mules are given a section of road varying from 20 to 30 miles. They keep the gutters clean, keep the bushes cut back, haul on surfacing material where it is necessary, and drag the roads in the section where they happen to be after a rain. Each of the farmers along the road who have two or more horses are given a road drag, which costs us about \$2.50. We select one of these for about every 8 miles to attend to the dragging. After a rain, if the roads need it, these men are instructed to drag their section. If we find that the road needs it badly and the regular man hasn't been attending to it we telephone another man that has a drag and ask him to drag it. Every time a man drags he sends in a bill to my office and receives a check back for the amount of labor for his team and himself. In some sections we are quite successful in getting men to drag at the proper time, and in other sections we find considerable difficulty, but we are gradually getting more and more men to look out for this work.

In many sections of the United States there is some material that makes a good cheap road, and if a competent man and a pair of horses are kept on this work continuously under the direction of some intelligent citizen, and if the road is dragged frequently, you will find that the expense on these earth roads is very small per mile, and that they will be satisfactory for twelve months in the year in most places, and for the greater part of the year in others.

MR. SMITH (of New Jersey): We are not paying enough attention to the matter of cheaper roads in this country. I drove from Miami, Florida, to Philadelphia, and passed over every kind of roads, and it is possible and is good policy for us to take up and give more attention to the cheaper roads in the country and see how they can be made better and protected, rather than spend all our money on these high priced roads of cement and brick and asphalt and water bound macadam and all the rest. They are all right for the cities and great highways but not for the country roads and I am sure that this matter of gravel and sand clay roads ought to be taken up more thoroughly by the Convention.

A MEMBER: I want to make an entry for competition. In Jasper County, Missouri, we have 600 miles of gravel roads. You can go there with your automobile today and break the speed limit without vibrating your springs. They are kept that way by continual dragging with traction engines and drags weighing two or three thousand pounds. We drag 10 or 12 miles a day with those engines.

A MEMBER: I would like to ask Mr. Hooker if they roll gravel roads in New Hampshire?

MR. HOOKER: We do roll them, we roll them with regular ten-ton rollers, where we have them. In some instances we have got to roll them with a corrugated roller drawn by oxen, but if you haven't got a corrugated roll, you can put your road in just the same condition after a rain by the use of a drag.

MR. HILLIARD (of Michigan): I want to say that the experience of the road builders in upper Michigan confirms all that Mr. Hooker and Mr. Tufts have said regarding gravel and dirt roads.

MR. ATKINSON (of Louisiana): How do you apply your gravel?

MR. HOOKER: I put my sub grade on the 21 foot road 3 inches higher than the finished.

MR. ATKINSON: Do you have a shoulder or apply the gravel the entire width of the road?

MR. HOOKER: I prefer it without the earth shoulder, giving the gravel the entire width of the road. The other way, we build a shoulder and 15 feet of gravel 8 inches thick, 11 inches in the center and 8 inches on the outside.

MR. EBERHARDT (of Pennsylvania): We take the road machine first and grade the road, then haul the gravel 4 to 6 miles, place it 6 to 8 inches deep with the dump wagon, spread this from the dump wagon, use rakes and thereby get at the lumps and make an even and good grade of road. It costs \$1600 to \$2000 a mile and it can be maintained three to four years at an average expense of \$200 to \$300 a mile.

THE CHAIRMAN: If there is no further discussion, we will proceed to the next subject on our program. Colonel Stevens is not here, but his paper on "The Treatment of Wornout and Ravelled Macadam Surfaces" will be discussed by Hon. Robert C. Terrell, State commissioner of public roads of Kentucky.

TREATMENT OF WORNOUT AND RAVELLED MACADAM SURFACES

BY COL. EDMUND A. STEVENS

State Highway Commissioner of New Jersey

Before discussing the cure it is well to define the trouble, and to analyze its causes. The word "ravelling" is used rather loosely. For my purpose I shall consider it as the loosening of the bond of a road surface until the macadam stone lies loose and free on the road. By macadam stone, I mean, not the small stone used to fill voids and give a smooth finish to the surface, but the stone that con-

stitutes the body of the road's surface. In macadam work this stone when compressed to its final form occupies about 60 per cent of the volume of the road surface. The 40 per cent of voids is filled in varying proportion with surface stone, screenings, stone dust, sand, earthy materials and any chemical binder used to "hold the road." The mixture of fine stone, sand and earth filling the voids has no appreciable tensile strength. Its duty is to wedge the macadam stone in place and prevent internal movement. Such a structure is called on to carry loads, to receive and absorb propelling thrusts. The road should be of sufficient depth to transfer the stresses thus imposed to the sub-base without serious internal movement and at unit pressure less than the resisting power of the soil. It is thus subjected to vertical and horizontal forces that contribute largely to ravelling.

Let us briefly consider these.

A draft horse weighing 1200 pounds will have all his weight at one time on two feet. He will exert say 1 h.p. at a speed of 4 miles. The vertical forces at the foot is 600 pounds, the horizontal $\frac{23,000}{2 \times 4 \times 88} = 47$ pounds. These forces are or may well be concentrated on a toe calk 2 inches in width; the resultant force slightly exceeding 300 pounds per linear inch.

A motor truck weighing, loaded, 16,000 pounds and exerting at the wheel rims say 30 h.p. at 10 miles an hour, will with 60 per cent of load on rear axle, exert a vertical force of 4800 pounds and a horizontal of 562.5 pounds at each rear rim, the resultant being about 800 pounds per lineal inch for 6-inch tire.

For a pleasure car weighing 4000 pounds with 60 per cent of weight on rear axle and exerting 40 h.p. at the wheel rims with a speed of 35 miles, the vertical force at each wheel is 1200 and the horizontal 214. The resultant is about 400 per linear inch for a bearing width of 3 inches.

At curves with high speed cars, the horizontal force is considerably increased, for it is impossible to so "bank" a curve as to suit the speed of all classes of traffic.

In the case of wheels transmitting vertical loads only, observation indicates but little dust raising from a road not overlaid with loose dust. Such a wheel will at the point of mathematical tangency have no velocity relative to the road; a vertical velocity is imparted to it and as any section leaves the surface it will raise with it any of the lighter particles that are loose and may come into contact with it. At the driving wheel there is a slight slip which in addition to lifting will throw particles backwards.

These are the forces tearing at the road surface. In some cases they are more than the road can stand. The horse's calk acts somewhat like a chisel. It will pry out the binding material between the stones as well as the latter themselves when the bond is weakened. The driving wheels of motor vehicles push or suck any ma-

terial thus loosened out of place. The binder loses weight as it parts with moisture; besides this, without moisture it also loses, not only its property of recementing itself under pressure but to a great extent, its binding power as well. The real work of transmitting the stresses due to traffic must be borne by the stone. These are merely held in place by the binder. The latter is gouged out by the horse, drawn or pushed out by the automobile tire, blown away by the wind, or washed off by the rain and a loosening of the upper stone results.

Even on a well consolidated road climate stresses impose a heavy duty. If, however, there be voids the risk of failure increases. Voids may be due to deficient rolling or to the rise of too much clay in the earthy binder. Lumps of this material will bridge the spaces between stones even under hard rolling. The bridge will break down eventually either from pressure or moisture or a combination of them. A void forms where the bridge was and continues rising until near the surface when ravelling results. The same may be true in the cases of too light rolling.

When bituminous material is used as binder it is liable to disintegration from weathering, from overheating or from admixture of earthy materials.

An ordinary water bound macadam may lose material by wear up to a thickness of about a half an inch a year without being overloaded. The thickness that can thus be lost will vary with conditions, one of which probably is the ratio of the maximum wheel load to the total tonnage borne by the road.

Whatever the rate of waste it must be replaced if the road is to be maintained.

To summarize the foregoing, roads ravel from: (1) improper construction, (2) overload, (3) neglect. In all cases these affect the binder.

Poor workmanship in construction can only be cured by remedying the original defects. These generally show themselves by small local depressions in the surface from which ravelling spreads, in certain cases at an almost incredible speed. In bituminous surface faulty material and thin spots generally show up clearly. In both cases the only remedy is to rebuild the work properly, if necessary, from the sub-base up. This is not strictly repair work.

In considering the effect of overloading and neglect it must be borne in mind that any given type of construction may be so maintained as to vastly increase its carrying capacity. The problem is largely one of economics and administration. As an illustration, assume in two cases the same foundation—let one road have a water bound macadam surface dressed with a heavy bitumen forming a sheet about $\frac{1}{2}$ -inch in thickness and the other a bituminous concrete (mixed method) surface of say 2 inches. The former will cost about 40 cents for stone and 15 cents for dressing, or 55 cents per square yard, and the latter about \$1 (both exclusive of the founda-

tions). With proper care the lighter surface will last about three years under fairly heavy traffic, the heavier one an unknown period, but let us assume twelve years. The total yearly charges against the two may then be stated about as follows:

Dressed macadam

	<i>cents</i>
Interest on cost, 55 cents at 4 per cent	2.2
Depreciation, $\frac{1}{3}$ of 15 cents.....	5.0
Labor (patrol system).....	1.9
Materials { Stone $\frac{3}{8}$ cubic foot at 9 cents	3.4
{ Bitumen $\frac{1}{8}$ gallon at 12 cents	1.5
Total.....	14.0

Bituminous concrete

	<i>cents</i>
Interest on cost, \$1 at 4 per cent.....	4.0
Depreciation, 1.00/12.....	8.3
Labor.....	0.9
Material.....	0.8
Total.....	14.0

The fixed charges are 7.2 cents against 12.3 cents.

The operating charges 6.8 cents against 1.7 cents.

I do not claim that these figures are more than illustrations of the principle involved. They show a great saving in operating charges, those that show up in the yearly tax bill. The fixed charges, however, are just as real and must be met at some date.

For a road with 9,500 sq. yards per mile the costs as shown in yearly tax charges, where depreciation and interest are not visible, would in this case be,

For the dressed macadam, per mile.....	\$636.50
For the bituminous concrete.....	161.50

yet as shown above the real cost of the two roads is the same. This case affects our subject because the treatment of a ravelled road surface must depend on the system of maintenance.

In most communities the great consideration is the next yearly tax bill. If that can be kept down for a period the ultimate economy of such a policy receives but slight attention. It is generally easier to get money for a new road than for repairs. A road requiring a large yearly repair charge is condemned without a hearing. The road calling for heavy interest and depreciation charges may be an equally or even more expensive solution; but the interest charge is not so apparent and the depreciation charge is not made. This is simply putting off the day of reckoning which is sure to come. However, the troubles of those in charge ten years hence are usually lightly borne by the officials of today.

If we consider the structure of the road surface we can easily see that the 40 per cent of voids in the macadam stone will be filled somewhat as follows:

Surface stone passing 1-inch ring and caught on $\frac{1}{2}$ -inch ring,	15 to 20 per cent
Screenings, passing $\frac{1}{2}$ -inch ring.....	15 to 10 per cent

When dry the clay is driven off to a greater or less extent as dust, washed away or splashed off as mud. Its place is supplied to some extent by detritus the result of the wear of the larger and heavier materials. These also blow or wash away and the road loses its bond. If our road is not overloaded we can retain its usefulness by making good its losses, with proper materials in their needed proportion. It is here that the trained road man is most needed. Nothing can replace his experienced judgment.

In the case of a ravelled road having first determined that the road was well built we must decide whether the traffic is too great for the type of surface, or whether the failure was due to neglect. If the former we must resurface with some better type. If the latter we can repair the old surface.

Resurfacing should always be preceded by scarifying and by bringing the road up to the necessary depth of stone. For water bound macadam needing greater surface strength several classes of chemical binder may be used of which I shall discuss two, bitumen and lignin.

The bitumen may be applied either by penetration or mixing methods. The former is the cheaper, the latter the more trustworthy. Which method is to be used will, after consideration of the care the road will receive, depend on the estimate of the overload, as will also the depth of the bituminous sheet. My own observation leads me to question the wisdom of attempting to get any thickness exceeding one half inch by penetration methods. It also leads me for this class of work to prefer tar to asphalt. The former material appears less sensitive to injury by dirt and to yield better results in repair work.

The lignin binders are derived from the waste products of wood pulp or tannin manufacture. They are cements being also used to bind core sand in foundry work and impart a tensile strength to the binding materials. They will not act on materials soaked in the so called road oils. The action of some of these materials on slag and red shale is quite remarkable. They are slightly soluble in water and will therefore need renewal. Their application, however, is easy and inexpensive and the effect of successive applications seems cumulative, increasing not only the depth of penetration but the strength of the bond. The water proofing of lignin bound roads with bituminous tops has been carried out in Connecticut but I am unable to give any facts as to the results.

For water bound macadam roads that have failed through neglect a thin coat of gravel carrying some earthy matter or of screenings or coarse sand mixed with earth will usually cure cases that have not gone too far. In some of the counties of New Jersey it is usual to fill all ruts, depressions, etc., with fine stone and to give the middle of

the road a coat of the same mixed with a little clay. Much of this material is wasted by being thrown off the road by the traffic, and old ruts almost invariably reappear. This method, however, is very successful in preventing ravelling. It seems a false economy to omit rolling and wet rolling, at that. The same is true of patching holes with anything but macadam size stone. The roads treated with small stone are yearly losing depth. The moisture for wet rolling is usually bountifully supplied by nature in the early spring. It can also be had by the use of hygroscopic salts where water is hard to get. Traffic will usually throw off from the road surface enough stone to pay for rolling.

A treatment of clay, without rolling, will often give astonishing results. Such treatment, however, seems only a palliative not a cure. Roads thus treated become dusty or muddy according to the weather, show a tendency to ravel again and are hard to properly treat with bitumens. They will, however, take the lignin binders with good results, if the dose of clay has not been excessive, or if the excess is swept off before treatment.

In closing a word of warning as to the use of the so called cold oils may not be out of place. Those of the so called non-asphaltic class, to a greater extent than the so called light asphaltic oils, seem to act as lubricant on road materials and to foster pot holes, ravelling, and other failures. It may be possible to properly apply these materials but if so it is rarely done. It is certain that even slight depressions will cause a deep penetration of the road. The dust laying qualities of the material thus absorbed are lost and its lubricating effect given the best possible conditions to get in its pernicious work. Local authorities and even private individuals seem to select roads with uneven surfaces as those on which to use these oils.

MR. ROBERT C. TERRELL: In discussing this excellent paper and this very important subject, I wish to say that Colonel Stevens' paper shows that he has given this most vexing problem a good deal of time and thought and his explanation of the causes of the ravelling of the macadam road is beyond question. However, I disagree with him, in so far as he advocates the use of earthly materials as a binder, since earthly materials not only render the surface susceptible to retaining water but also permits the percolating of water into the subgrade.

The discussion in this paper showing the effect of motor trucks and motor driven vehicles, shows conclusively that an excess of screening or the use of earthly materials for a builder are objectionable. The tendency of water bound macadam roads to ravel under heavy motor traffic, may be largely overcome by increasing the size of the stone in the top course and using only a sufficient amount of screening and stone dust to cement the whole together after being thoroughly wet and rolled. The larger stone should be plainly visible on the surface and the surface should have the appearance of a conglomerate rock that has been cut with a saw.

Colonel Stevens says, "Whatever the rate that wastes, it must be replaced if the road is to be maintained." This is very true, however, if the road be worn uniformly, it will not be economical to try to replace the amount worn off, by fine stone but sufficient time should elapse to justify the placing of a course of stone sufficient to bear the traffic and not be blown away by rapidly moving vehicles. But uniform wear is rarely the case. Where ruts and large holes occur they should be promptly filled, not with small stone but stone of the same size and character as that in the surrounding course and well tamped.

The discussion of the bituminous surfaces is carefully worked out and I shall not attempt to go into detail on the discussion of figures for bituminous macadam and bituminous concrete. It is very evident that the following statement from Colonel Stevens' paper is the correct status of affairs throughout the country, "In most instances the great consideration is the next yearly tax bill. If that can be kept down for a period, the ultimate economy of such a policy receives but slight attention. It is generally easier to get money for new roads than for repair." In order to properly maintain a road must of necessity have been properly constructed and since it is generally conceded that water bound macadam road is not satisfactory under heavy motor traffic and it is necessary to employ some sort of bituminous treatment. The heavy asphaltic oils have been used very successfully on the water bound macadam roads of Kentucky, and have given excellent results. However, the road to receive this oil should have been built at least six months in advance of its first treatment, in order to give the stone time to season or rid itself of the quarry sap. All the excess dust and foreign material should be carefully swept from the surface of the road and the oil applied evenly over the entire macadam surface. Traffic should be suspended until the oil has had time to penetrate. This can be accomplished by oiling one side at a time, thus permitting the use of the other side of the road. If the oil is not applied evenly, the surface will generally ravel or form pot holes where the surface fails to receive the treatment. The road should receive one treatment of the oil each year, in the early spring. If, however the same macadam on which oils or bituminous concrete are used, (a surface free from ruts or depressions) a treatment of Kentucky rock asphalt should be placed 2 inches in thickness and properly rolled. The maintenance charges will at once become a minimum. This Kentucky rock asphalt may be applied cold after having been prepared by grinding. It is not only efficient but easy to place and requires but little attention after it has been thoroughly consolidated. I believe that this material can be economically used for surfacing and for maintenance purposes anywhere within a radius of 1000 miles of the Kentucky field. The material of which I speak is a sand stone pregated with about ten to twelve per cent of asphalt and is found in Edmonson County, Kentucky, there being about 80,000 acres of this deposit ranging

in thickness from 12 to 50 feet. In 1906, or about that time the United States government constructed approximately a half mile of road of this material, near Bowling Green, which is now in an excellent state of preservation and shows little or no bad results from its constant and heavy use. It is safe to say that this material would not cost more than 50 cents per square yard in place anywhere within a radius of 500 miles. I believe that that price can materially be reduced when the field is more fully developed.

This material can be used with same results at a thickness of 1-inch after consolidation, which would double the number of square yards per ton of material but of course cut down the life of the road.

Under the advance system of road construction and the heavy motor traffic, I do not believe it economy to recommend or to permit the building of stone roads without the use of the roller, and while Colonel Stevens says "A treatment of clay without rolling will give astonishing results." I agree with him and also his latter statement in which he states, "Roads thus treated become dusty or muddy according to the weather." I believe such treatment of our roads should be discouraged as far as possible.

MR. UNDERWOOD: I want to say to you gentlemen of the Convention that we have no business to let a gravel road wear out; it is absolute foolishness. What in the name of common sense is the use of building a thing and then sitting down and letting it wear out? It is absolute nonsense. In the city of Battle Creek, where I am commissioner of public works, we have some gravel streets. In the surrounding country outside of Battle Creek, we have some gravel roads. Let me tell you the difference between the way in which these gravel roads are kept up. In the city of Battle Creek, we don't drag our streets, it doesn't amount to a row of pins to put a drag onto a hard graveled street that has got holes in it; what you want in the holes is some more gravel, and that is what we put into the holes in the graveled streets of Battle Creek. Every year we go over our streets and fill every hole with gravel. When that hole has got water in it, we know where the hole is then and plug it up and it stays plugged up for a year and possibly for more than a year. Now, the way they do out in the country surrounding Battle Creek, they let their roads go until they are so full of holes that when it rains they are simply a continuous streak of ponds of water, and then they undertake to fill those holes by dragging the roads, and that is absolutely fooling away your money. I want to tell you gentlemen of this Congress that if you want to keep up a gravel road, you have got to fill the holes. Its the same way if I want to keep up my coat and a hole gets in it, I have got to patch the hole.

MR. SMITH (of New Jersey): We run the steam roller and the disc harrow over them and then they are in good condition to spread again.

THE CHAIRMAN: Mr. John S. Gillespie will now deliver an address on "Development and Maintenance of Highways in Allegheny County, Pennsylvania."

DEVELOPMENT AND MAINTENANCE OF HIGHWAYS IN ALLEGHENY COUNTY, PENNSYLVANIA

BY JOHN S. GILLESPIE

Road Commissioner

Allegheny County, Pennsylvania, was created by an act of the State legislature on September 24, 1788, being formed from parts of Westmoreland and Washington Counties. In 1789 an additional part of Washington County was annexed. It then comprised all the land north and west of the Ohio and Allegheny Rivers, but was subsequently reduced by the creation of Armstrong, Beaver, Crawford, Erie, Mercer, Venango and Warren, and parts of Indiana and Clarion Counties. Its area is approximately 755 square miles. Its population in 1860 was 178,831, the 1910 census showed a population of 1,018,000.

Allegheny County derived its name from a tribe of Indians called the "Allaghans," who formerly lived along the Allegheny River.

The surface is undulating and near the large streams hilly. The lands are fertile and make excellent farms. The great wealth of the county lies in its immense mineral resources. Bituminous coal of the finest quality abounds, varying in thickness from $5\frac{1}{2}$ to $8\frac{1}{2}$ feet.

The Allegheny and Monongahela Rivers join at Pittsburgh, forming the Ohio River.

Allegheny County is so situated that all its main roads lead to Pittsburgh which is in the center. These main roads lead to the outer borders of the county, connecting up with Butler, New Castle, Washington, Freeport, etc., with many cross connections. In fact its features resemble a wheel, Pittsburgh being the hub.

The question of good roads evidently was given careful consideration in years gone by, as in going over the court records we secure data pertaining to the old turnpikes and toll roads. These in the majority of instances were planked roads, having a plank roadway 8 feet in width with an earthen or summer road alongside; and, I might state that even today there are several miles of such roads in our county. There are, however, no toll roads in the county, the same having been condemned and purchased by the county, and then dedicated to the public as free roads.

Sentiment for good roads continued to grow, for in the early part of 1895, the governor of Pennsylvania approved what is known as the "Flinn road act." This act provided for the laying out, straightening, widening, altering and otherwise improving of the then existing highways. It provided for the issuing of road bonds or a direct tax, in payment of such improvements; also, it provided for the levy of a road tax by the county for maintenance, sinking fund charges, etc.

It was under this act that the road department of Allegheny County was created, and the department has been an important feature of the county commissioners' ever since. This act was effective until May 11, 1911, when a new act was approved. This new act provides for the improvement of routes through cities and boroughs thereby connecting up with the road system in general as laid out by the county commissioners. This new act also increased the bonding power of the county for road improvement, allowing the issuance of 2 per cent of the assessed valuation, without being compelled to submit the matter to the voters for a referendum vote. Under this act the county commissioners are permitted to issue bonds to the amount of \$22,000,000.

The present commissioners of Allegheny County are Irvin K. Campbell, J. Denny O'Neil and Stephen J. Toole, the present term being their second term in office. This board has always been active in road improvement, they have given the matters of construction and maintenance their earnest consideration, and the present excellent system of county roads is the result of their earnest efforts.

The road department commenced building roads in August, 1897, and the work has been continued ever since. We feel we have accomplished a little in the way of road improvement but we have lots to learn as this is a big proposition. It is important and cannot be solved in a day or a year. There are many conditions to consider, what may be a good road for one section will not answer in another. We first started by building macadam roads, having a telford foundation 8 inches in depth with a macadam wearing surface 4 inches thick. Our roads are all graded 30 feet wide and in the majority of cases the improved portion is constructed 16 feet in width, in a few cases we only improve 14 feet.

Up to the end of 1905 we had 153.7 miles of macadam road, today we have 437 miles of improved roads of various kinds, completed and under construction. Aside from this there are 22 miles of plank roads. The two remaining planked roads, however, have been taken over by the highway department of Pennsylvania, being a part of the famous Sproul system. Portions of these plank roads have been improved with brick and asphalt-macadam construction and it will be but a short time until they are a thing of the past, the remaining portions, it is hoped, will be replaced with a permanent road in a short time.

Under the acts already mentioned the County of Allegheny, up to the end of 1912, issued \$10,250,000 in road bonds. A road tax, varying from $\frac{2}{10}$ of a mill (this being the tax levy in 1902) to $\frac{3}{4}$ of a mill (the present tax levy), has yielded \$4,449,040.90, this having been applied to maintenance and sinking fund charges. The sinking fund charges from 1902 to 1912 amounted to \$3,904,791.10, leaving \$10,794,249.80 as a net amount for road purposes.

At the time we commenced building macadam roads, they were considered the "ideal roads." Conditions alter cases, however, and

with the advent of the automobile, the heavy truck, and continued use of narrow tires, it was readily seen that a more substantial road would have to be considered. Narrow tires play an important part in the ruination of a macadam road. Our roads, we think, are constructed right, the best of material obtainable is used for the surface and still the macadam road cuts into ruts. Our board of commissioners at once realized that a more durable road would have to be adopted, so in 1909, after a careful investigation of roads in and through the eastern States, they awarded contracts for the first asphaltic-concrete surfaces in Allegheny County. The ease with which this surface is laid, the slight inconvenience afforded the travelling public, and the fact that it is a dustless road, convinced the commissioners and the public in general that it was a step in the right direction, towards solving the road question. Since constructing the first asphaltic-concrete roads, our commissioners have received numerous requests for this class of pavement. I might state right here that the roads first treated with this asphaltic-concrete surface were those that were subjected to the heaviest kind of travel. They are main routes to Freeport, Pa., and to Steubenville, Ohio, and are subjected to all kinds of automobile travel, hauling of heavy builders' supplies, etc. Neither of the roads constructed during 1910 have as yet required one penny of cost for maintenance, and present conditions seem to be improving with age.

The asphaltic-concrete road while costing more than the old style macadam is cheaper in the end when one considers the matter of maintenance. We feel that we will not be required to do anything in the way of repairs for eight to ten years, while with the macadam road our conditions require resurfacing, or top dressing, every two or three years at most. The macadam road, you all know, is a disagreeable road in wet weather. Mud from the side roads is dragged on, and remains there until dried out by the sun. While mud is also dragged on to the bituminous road, the first rain washes the surface clean. With the hot mixed material no delay is suffered by passing vehicles, the road is at all times open to travel, while the macadam road suffers more or less during the time of resurfacing, until the same has thoroughly bonded. This makes an ideal road through villages and in residential sections. This bitulithic pavement is made of crushed stone, sand and asphalt. The stone is mixed in predetermined proportions as regards sizes, to provide a maximum density and minimum of voids, so that when rolled in place it is nearly as dense as a block of solid stone. The surface offers as little resistance to traction as asphalt; it is not slippery. The small stone used provides a gritty surface somewhat similar to macadam and affords a secure footing for horses at all times. The application of the seal coat makes the road practically water-proof. It easily supports the passage of high speed vehicles, and heavy travel, without loosening the bituminous filler and therefore does not affect the stone, and no dust comes from the pavement or its material.

In using the term "asphaltic concrete" I wish to make it clear that I do not refer to the form of construction which has been exploited during the past two or three years and misnamed "asphaltic concrete," being merely a sheet asphalt or mortar pavement (less the essential binder course) with a very little (the specifications say "less than 10 per cent" which may be none) crusher screenings coarser than $\frac{1}{4}$ -inch size. The presence of this small percentage of fine crushed stone surrounded or "floating" in mortar in my opinion makes the construction weaker than a pure "asphaltic mortar" without the screenings for the reason that the tendency of traffic is to dislodge one of the other detached particles of stone which may be near the surface.

The asphaltic concrete of Allegheny County measures well up to the clear concise definition adopted by the American Society of Municipal Improvements for *true asphaltic concrete*, as follows:

Bituminous concrete is a pavement consisting of a combination of broken stone and sand, or fine mineral matter, cemented together with a bituminous cement, and which has all its ingredients mechanically mixed before being laid. To be termed a bituminous concrete it must partake of the well known characteristics of concrete, that is, there must be stone enough in its composition to form an important part thereof and add to its strength and durability; also, there must be enough of the mortar constituent, that is, the sand and bituminous cement, to properly support and bond together the largest particles.

This differentiation between the true, real and the spurious misnamed "asphaltic concrete" is most important.

The maintenance of the macadam road is expensive in our county. We do not have any local stone that will answer, it is all shipped in by rail. In the majority of cases we have hauls of 4 to 6, and in some cases 8 and 9 miles from the railroad to the road. This material must be handled a couple of times and you can readily appreciate why our macadam roads cost so much.

While we have paid considerable attention to the asphaltic concrete road, asphalt penetration work also was carried on. Various grades of asphalt were used for this work, and the roads laid to date all seem to be in excellent condition. Close on to 45 miles of this class of road has been laid. This pavement has been laid on roads that are not subjected to as heavy travel as the ones on which we place asphaltic concrete.

The brick road has not been overlooked, either. Approximately 42 miles of brick roads have been laid. Probably half this mileage has been laid with the old macadam road as a base. This work is done by the maintenance branch of the road department. Brick construction costs \$22,000 to \$25,000 per mile, and covers 13 feet 6 inches of brick pavement, two concrete curbs (flush and combination curb and gutter types), with concrete base 5 inches in depth. It also covers grading, drainage, etc. As a matter of general information to those who have not gone over any of our roads and will probably question the reason of our high costs, would say that our grading

averages 11,000 to 12,500 cubic yards per mile of road. Many streams are encountered, and the construction of culverts and bridges further add to the cost. As herein stated, a large part of our brick work has been done by our maintenance branch using the old macadam road as the base. The surface is scarified and formed to a true cross section, concrete curbs built, sand cushion planed and the brick laid. The surface is then grouted with a cement and sand mixture of equal parts. We find that the increased life of the road laid on this old macadam base, gives us a road much cheaper than with the concrete base and we get a solid foundation. One of the bad features in connection with this class of pavement is the grinding off of the brick at the expansion joints alongside the curb, and the breaking off and grinding up of the concrete curb.

A large percentage of the asphaltic concrete roads in Allegheny County have been laid over the old macadam utilized as a foundation after levelling up and scarifying where the contour or depressions are such as to require such regulation of grade. It is my belief based on our practical experience of four years' use in Allegheny County that this is the most economical and successful method of conserving the macadam on country thoroughfares on which the automobile traffic has become so great as to make it impracticable and uneconomical to longer maintain the macadam as a wearing surface.

The macadam road has not been entirely eliminated in Allegheny County. Where traffic is light and particularly in the outlying sections, this class of surface is still laid. In this year's reconstruction work by our maintenance department, we are laying about 8 or 9 miles of water bond macadam. In order to prolong the life of our macadam roads, we have done considerable in the way of experimenting with light and heavy bodied asphalt oils, using screenings and torpedo gravel in connection therewith. The light oils are mostly used for dust laying purposes. This is an important part of our season's work, the passing automobiles and even the slower vehicles raise immense clouds of dust, and we are compelled to keep a force of eight tank wagons busy applying oil, to relieve the people that reside along the macadam roads. We are just about completing our 1913 oiling, and to date we have used over 250,000 gallons of oil.

Now, as you can see we have been endeavoring to find the ideal road; our roads cost a lot of money. We endeavor at all times to build them right and to keep them in the very best shape possible. In passing from the waterbond macadam road to the asphaltic concrete road, we feel we have taken a step in the right direction. Our experiments have demonstrated that it is the ideal road. It is necessary however, that the material be mixed with good asphalt. There are many many kinds of asphalt on the market today, and to take and use the cheap grades, we feel it is a mistake. On the Freeport Road which was the first road we reconstructed with this kind of surface in 1910, this spring a huge slip occurred carrying part of our road away with it. Repairs were necessary to this portion, and from the part

that slipped away, we had samples cut out (I have a sample or two with me, the same showing its vertical cross section and if any desire to examine the same will be glad to show them). This sample does not show any wear whatever. The asphalt used in its mixture was the best that could be obtained, and in the sample taken up the asphalt still retained plenty of life. The chief chemist of the New Jersey highway department happened to be in Pittsburgh at the time I received the sample, and he expressed great surprise at the condition of the asphalt, considering length of time in use, etc.

Last, but not least, in the matter of highway improvement, Allegheny County was not only among the first in the matter of road improvement, but at the same time we inaugurated a "patrol system." This system has been in service since the completion of our first roads, and is added to as occasion demands. Today we have 128 caretakers on our various roads. We endeavor to place a man on each road, that is, we give each of our caretakers 4 to 5 miles of road to care for. It is the duty of these men to keep the roads in good shape at all times, that is, insofar as minor repairs are concerned. They are required to look after the drains, the earthen road alongside the improved portion must be kept free from grass and weeds, all loose stones must be removed from the road, and they must look after the removal of all small slips or slides. Also, the matter of obstructions, such as telephone and telegraph poles, sewer heads, bridge walls and copings, etc., the same must be whitened or whitewashed. These act as a guide to the traveling public and are very much appreciated. They also are required to keep the department advised of any and all accidents that might occur, making detailed report of the same.

In conclusion, while we have accomplished something in the way of road building, we feel that we have just commenced. Each day presents something new. The records furnished you deal entirely with the County of Allegheny. We have several miles of road improved by the highway department of Pennsylvania. No aid was extended to the county in its system of roads, but in order to get additional mileage of improved roads, the county has, in numerous cases, joined with the State in improving of State roads within the limits of the county, paying one-eighth and in some cases one-fourth of the total cost.

While our county occupies a foremost place in the movement for "better roads," it possibly might be interesting to some to know how this proposition is financed. As before stated, road improvements in our county are carried on by the issue of bonds. The assessed valuation of our county is greater than that of the States of Maine, New Hampshire and Vermont combined, totalling \$1,175,000,000. By issuing road bonds, and thereby allowing future generations to share in the cost, we are able to operate with a low road tax.

THE CHAIRMAN: The chair will have to make a general apology to everyone who talks here, but in order to give everyone a chance,

we have got to limit ourselves rather closely. The next subject we have got to discuss is "Bituminous Macadam, Construction and Maintenance," by Mr. S. D. Foster, chief engineer of the State highway department of Pennsylvania.

BITUMINOUS CONSTRUCTION

By S. D. FOSTER

Chief Engineer Pennsylvania State Highway Commission

The subject of bituminous construction, the one upon which I have been invited to speak, is such a broad one, and one upon which so much has been said and written, that I will not attempt to discuss its merits, compare it with other types of pavements, or take up the correct method of maintenance after construction, but will deal entirely with the two types of construction most commonly used by engineers today, viz: The bituminous road constructed by penetration method, and the bituminous road constructed by mixing method.

Speaking generally of the two methods of construction, and taking into account the hundreds of miles of bituminous roads already constructed, I feel safe in saying that there is probably no other type of construction about which there is less absolute information concerning the physical and chemical characteristics of the bituminous materials and the road metals which will bring about the best results. There is no type of road construction which requires more care or more consistent expert supervision and inspection than that involved in the use of bituminous material, and, until such time as we are able to thoroughly educate and instruct efficient and capable engineers and inspectors in this type of construction, the same will remain in an experimental stage. In general, also, I would state that the preparation of the sub-grade, the drainage, and the foundation are extremely important in the success of bituminous pavements, and, unless properly constructed, will bring about their destruction. I might state at this time that, to my mind, the experimental stage in foundation work has been passed, and, that for the ordinary country traffic to which the average highways must be subjected, an 8-inch telford foundation, or a 5-inch cement concrete foundation, when properly constructed, is sufficient for the carrying of any class of pavement which we may desire to place thereon.

Presuming that the foundation has been properly completed, I do not believe that I can better describe the method of building thereon a bituminous penetration pavement than by quoting from the Pennsylvania State highway department's specifications, to wit:

Upon a suitable foundation there shall be spread a layer of broken stone of such quality as may be suitable. The stone shall be broken in fairly uniform and regular cubes, free from dirt or dust, and comparatively free from flakes or splinters. The stone shall be of such size that they will pass a 1½-inch cir-

cular opening and over a $\frac{3}{4}$ -inch circular opening. This layer of stone shall be of such thickness that, when it has been rolled with at least a 10-ton power macadam roller, it shall have a thickness of 3 inches.

The surface must be firm and, when completed, correspond to the grade in proper crown of cross-section. Upon each square yard of this surface shall be evenly spread, by means of an approved pressure distributor or fan-spout sprinkling-pot, from $1\frac{1}{2}$ to $1\frac{3}{4}$ gallons of bituminous material, of a penetration from 90 to 120.

The bituminous material shall be heated to a temperature of approximately 350°F. Immediately thereafter, sufficient dry, dustless screenings, passing a $\frac{1}{2}$ -inch screen, shall be spread in sufficient quantities to evenly cover the entire surface of the road and take up excess bituminous material. The road shall then be rolled until firm and a smooth surface results and conforms to the longitudinal and transverse section.

While the surface is clean and warm, a seal coat of bituminous material of proper consistency to be flexible when cold, shall be spread $\frac{1}{2}$ gallon to the square yard. It shall be applied while at a temperature of 350°F., and, while the bituminous material is in a liquid state, there must be spread a top dressing of clean, dry, Torpedo sand, or dustless stone chips, in sufficient quantities to cover the entire surface of the road and take up any excess bituminous material.

Immediately thereafter, the road shall again be thoroughly rolled; if so directed, the stone, stone chips, and sand must be heated. In rolling, the roller should start from the side line and work toward the center, and, in all cases, continue until thorough compression is secured.

By following these instructions, a first-class penetration pavement can be constructed, but, in the experience of the department, the engineer has continually occurring the several conditions which I am about to enumerate, any one of which, escaping his attention, will be bound to produce a weak spot in the pavement, to wit: The presence of water in the foundation, due either to wet weather springs, or to rain-fall after the foundation has been placed. This condition results in water working up through the telford stone thence through the stone comprising the aggregate of the pavement and attacks the bituminous material, which losing its bonding powers readily disintegrates the pavement. Another condition oftentimes occurring, is due to the contractor not napping his telford properly and attempting to bring the same to the proper crown and cross-section by the use of stone spalls. These cannot be thoroughly rolled into the foundation, and, when the stone which is to be treated with bituminous material is hauled on the road, the spalls continually work up through the smaller stone and produce a weak place in the finished pavement.

The use of soft stone, especially in districts where local stone is used for road purposes, furnishes another problem for the engineer. Soft stone, when placed in the pavement and rolled, may seemingly be treated with bituminous material and thus cover up all cracks or fractures which may have been made by the initial rolling, but the rolling of the pavement, both after the first application of the bituminous material and by the final compacting of the same, will again fracture more or less of the stone aggregate. These fractures occurring as they do after the application of the bituminous material

will be void of binding qualities and the stone will immediately start to break down through continued rubbing, one piece against the other. This, in itself, produces dust and allows the moisture to penetrate into the pavement, again causing destruction to the bonding powers of the bituminous material. In addition, this soft stone is readily worn away by passing vehicles and serves to shorten the life of a bituminous pavement.

Stone crushed in quarries, where there is an abundance of stripping, or where there is a strata of soft stone, or stone hauled upon the highway and allowed to stand for several days subject to clouds of dust from passing vehicles, become covered with a fine film of dust particles. Stone of this character, when placed in the road and subjected to the application of bituminous material, cannot be properly bonded, inasmuch as the bituminous material, while covering each stone, is unable to directly bond itself to the stone proper, for the dust layer covering the stone will act as a barrier and, while the bituminous material will or may hold the stone in place in the pavement, it will not have the proper bonding of one particle of stone with another. Stone with a smooth non-porous surface will prove a failure on account of the inability of the bituminous material to adhere thereto. Wet or damp stones result, likewise, in the bituminous material not obtaining any adhesion. It is well also to avoid those classes of stone which do not crush in a cube or near-cubical shape. Stone that break or crush in splinters will not take the compression and will not interlock themselves one with the other in the manner most desired in accomplishing first-class results.

The selection of a suitable binder is a most important matter, requiring skill and judgment. There is no one "best" product, and the selection must be governed by a number of conditions. The principal features to be considered in this connection are: The characteristics of the stone to be used; the manner of applying the bituminous cement—whether the material is to be applied hot or cold, by means of distributors with or without pressure, or by pouring-pots;—the quantity and character of traffic to which the road will be subjected; climatic conditions; the cost of bituminous material; and the probable cost of application.

Inasmuch as the results to be obtained are the securing of a compact, uniformly solid paving surface, impervious to water, it is obvious that continued and experienced supervision and exceptional care be taken. Equally important with the selection of the bituminous material is the care with which it must be heated, as the slightest over-heating will burn the product and render it unfit as a binder. It has been my experience that no successful results can be accomplished unless the inspector keeps continually with him on the work a thermometer, with which to test the temperature to which the bituminous cement is being subjected. Another frequent failure occurs through lack of uniformity in the quantity of bituminous material applied to the stone and is caused by crude or careless ap-

plications, and cannot bring about proper results. The hand-pouring should be supplanted by suitable mechanical distributors which will apply the bituminous cements under pressure and insure thorough penetration and a more even application.

In enumerating the various mistakes which so often occur in penetration work, I would say that the cause of failures can be readily traced in many instances to faulty plans and specifications, lack of care and judgment in the selection of materials, poor and inadequate equipment with which to carry on the work, inexperienced labor for both skilled and unskilled service, continuation of work during unseasonable or inclement weather, and insufficient funds to expedite the work under way. I might say in passing that probably the most noticeable cause of failure is that a class of incompetent contractors, having absolutely no experience in bituminous construction, bid on highway work and look to the engineering department as a school of instruction for their guidance.

As to what the life of a bituminous penetration pavement will be, time alone can tell as the body of these roads contains a mass of material that is not evenly, properly, or finely graded. There exists sections that are both coarse and fine, permitting an application of the bituminous binder either in excess or deficiency; and, possibly, in some instances, only a light seal application is secured. While this condition does not exist generally, I must acknowledge that it is there and feel that wherever this method of construction has been, or is being, followed, it is only a question of time until the weak places show signs of disintegration; these, of course, can be repaired by an efficient maintenance force, and upon this maintenance force the probable length of life of this type of pavement depends. Where this class of pavement is supervised under the most expert management, the results at best are only those of a surface character and produce a road that for the time being seems to give satisfactory results.

Bituminous concrete pavements, constructed by the mixing together of stone, sand, and bituminous cement, in mechanical mixers, reduce the chance of failure to the minimum and eliminate many of the causes of failure found in penetration construction.

It is not necessary for me to discuss here the material, its size, quality, or character, or to explain in detail how this mixture is secured, as the average engineer is well acquainted with this type of pavement, inasmuch as it is very similar to the mixtures used in all the large cities for street purposes. While the best results from this type of pavement are obtained by using a cement concrete foundation, it is not absolutely necessary that such a foundation be used, as experience has demonstrated that water-bound macadam roads, where they have been properly drained, can be resurfaced with a mechanical mixture, and the results therefrom compare favorably with those of sheet asphalt streets. This type of construction has been a success and I feel safe in saying that most of the old water-

bound macadam roads that have been torn by the heavy traffic can readily be brought to grade, properly crowned, made firm, and covered with a bituminous concrete that will be economical and serviceable for many years.

I do not very much believe in the use of telford foundation for a mechanically-mixed surface, as it is almost impossible to obtain, upon a telford foundation, a surface that will not be more or less wavy, and we all know that bituminously-constructed pavements, which have a wavy surface, are soon doomed to destruction. In the construction of this type of pavement, there are a few points which must be closely watched: The first—and to my mind the greatest—is the resultant mixture produced by the majority of mixers at present in use. There is a tendency in all revolving mixers to bring the large stone together, and, unless in the dumping of the mixer this is closely watched, the purpose of mixing will be defeated, which is that of having the aggregate of different sizes so mixed as to give the lowest percentage of voids. This condition will again arise if the material has to be transported a very great distance from the mixer to the road, as there will be a tendency for the larger stone to work toward the top of the load and the smaller material toward the bottom. So, it is important, in placing the material in the pavement, that it should first be dumped upon a platform, and from there shoveled into place in as uniform a mixture as possible.

I have used two different distinct types of mixed bituminous construction: One, a cut-back bituminous material which remained in a plastic state for several days after being placed on the road, thereby bringing about a continuous bonding process, by means of local traffic passing over the road. The result of this was to bring about a perfectly smooth and uniform surface, in which there was probably from 70 to 80 per cent of mineral aggregate exposed, which furnished traction for horses' shoes and automobile tires, thus eliminating one of the great criticisms of this type of pavement. The other, a straight bituminous material of approximately 60 to 70 penetration, upon which a seal coat was used to bring about a smooth and compact surface.

Care should be exercised in determining the sizes of stone for the type of pavement which is to be constructed. From experience, I do not believe it wise to use any stone larger than will pass through a 1-inch ring, in the construction of a pavement upon cement concrete foundation, inasmuch as, in this type of pavement, while the load is seemingly carried upon the surface, it is in reality carried directly upon the foundation, and, if stone larger than 1 inch in size is used, there will be a likelihood of the larger stone occurring directly upon one another, thus throwing open the chance of fracture to either or both stones by impact from horses' shoes, or weight from the tires of heavily-loaded wagons.

Another point that does not favor the larger stone lies in the fact that sooner or later the stone is exposed in the surface in its largest

diameter, again placing it in a position to be fractured by traffic. When such fracture occurs, unless the pavement is treated from time to time with light applications of bituminous cement, it opens the way for moisture to enter the pavement and thus destroy the binding quality of the bituminous material.

Where ordinary care has been taken in the construction of mixed bituminous pavements which have come under my observation, the results obtained fully warrant a continuation of this kind of construction, and I believe that the time is not far distant when the experimental stages of these pavements will be a feature of the past, providing explicit specifications are drawn to plainly designate the quality of all bituminous and other material desired in each individual job, and the old practice of copying specifications and methods in use elsewhere, regardless of local conditions such as drainage, sub-base, and traffic, is discontinued; and providing we are successful in properly educating highway engineers, inspectors, contractors, and the forces, both skilled and otherwise, in connection with the use of all materials that enter into the construction of this class of paving; and I consider that in the very near future there will be little distinction between the general specifications that designate the construction of highway pavements and those that designate the construction of city streets, inasmuch as the automobile and automobile truck—which are the most dangerous factors in the destruction of the average pavement—will traverse the city street and the country road in equal numbers.

THE CHAIRMAN: The discussion on this paper was to be opened by Mr. W. A. McLean, provincial engineer of Ontario, Canada. Is Mr. McLean here? If not, the subject is open for discussion from the floor.

MR. GASH (of Illinois): I like the paper very well in some respects, but the thing that I am here at this Congress for is to learn not what the failures are but what we must do to make the successes. I like to hear the discussion of the successes of men like Washington, Jefferson and the great individuals of the world that have made successes, not those that have made mistakes, and if the last speaker would have told us what to do to keep away from those failures and the things to use to make the roads a success, I believe it would be better for us, and I would like to hear, in the future, the gentleman himself tell us what materials or some of the other gentlemen here tell us what materials should be used to get away from those failures.

MR. FOSTER: I might say that in taking up the failures we can by the elimination of those failures, bring about the success of either of the pavements discussed. We feel in Pennsylvania today that we have eliminated the mistakes and our specifications have been so arranged as to bring about results and I am only giving you the

mistakes to throw your inspectors and engineers a little bit more on the track of what they should look out for in the elimination of certain materials to bring about a permanent result. The paper, when fully read, will explain all that.

A MEMBER: I would like to ask what the experience is in regard to the penetration method? I come from El Paso County, which built about 55 miles of bituminous pavement or country road by the penetration method and we are thinking of going to the mixing method. I would like to have the results of your experience.

MR. FOSTER: That is all answered in my paper. I dealt with both methods. In the penetration method, your road is open to mistakes and there is more chance of failure. In a penetration road you have, at best, nothing but a surface treatment; it will probably give you satisfactory wear four or five years. With the mixed pavement which we call fool proof, because, except in rare instances, you cannot depend on the type of men you get to give it absolute attention and you are not dependent on the mixers; when the sand and the asphalt has passed through, that mixture is thoroughly coated and you have very much less chance of making the failures. In the penetration method you have to take into consideration the climatic conditions, the method of applying your bitumen, whether it is to be applied hot or cold, by force sprinkler or hand spout and a thousand and one things. We don't think that the results we have in Pennsylvania would be applicable in each State. My idea is that each engineer should study the conditions he is confronted with and make separate specifications covering each individual road, but in a mixed road, on a concrete foundation, you have less chance of failure, and while the cost is somewhat greater I think the life of that pavement will fully repay you for it.

MR. CURRIE (of Ottawa): I am very much pleased to hear Mr. Gillespie's interesting paper that he read a few minutes ago, saying that he adhered to a Telford base on his roads. My opinion and the experience I have had, I think a Telford base is much preferable to the ordinary macadam base that you get usually from the crusher. In nine cases out of ten, in a macadam base, large stones, say 3 or 4 inches—you get very large quantities of flat stone which, by some extraordinary process, works through the ordinary macadam and works to the surface of your road, and after a considerable quantity of traffic has been over that road a rut is formed. This gentleman in front of me here asked for some of the successes of mixed or penetration processes on bituminous macadam roads. Up to a few months ago I was engineer for a little city called West Lawrence, close to Montreal, and had considerable success with the mixed method of applying tar, principally, and quite the reverse with the penetration method. The penetration process I found took

something like 3 gallons of tar per square yard, whereas, the mixed method took something slightly under 2 gallons per square yard. The penetration process, after traffic had been over it, the tar started to buckle up on the surface and in the hot weather became a menace and a nuisance both to pedestrians and vehicular traffic. We had quite the contrary experience with the mixed method; taking our stone, first of all heating it, freeing it from all dirt and moisture and afterwards applying hot tar and also mixing it in the mixer. That formed a glaze, really, over the Telford base. Over that we put smaller stone and treated it in a similar manner. After finishing, we painted over the surface with this particular tar we used; on top of that we put small screenings, screenings that perhaps would pass through a $\frac{1}{4}$ -inch mesh, and I must say that we had considerable success with that class of construction. Another class of construction with which we also had considerable success was taking the ordinary water bound macadam road construction, which I need not enlarge on. After the road has been under traffic say two or three weeks, we apply one coat of tar paint on top and after that dried in we put another on and then screenings on top, and we had considerable success with it.

A MEMBER: I came here to learn and have learned a great deal. I am somewhat enthused now regarding Congress passing laws in order that we can have thoroughfares from one end of the country to the other. I have heard discussions here on different roads. I represent Macklin County as county commissioner, and I have taken a great deal of interest in road building, and we have tried everything; we have tried brick, asphalt and everything else, and as one gentleman from Michigan said a while ago, the secret is maintenance. For illustration, when I started from Columbus, my wife overhauled my valise and found a button off my overcoat. She said "It has to be repaired before you can go." I only had fifteen minutes to make the train, but she sewed that button on, repaired the coat, and we have got to take care of these roads, we found that out. We have got six crews taking care of these roads. We have got the gravel roads, we take one of these crews to a gravel road, fix it up, roll it good and make a good road of it. We come to another road, water bound macadam, and we go to work and fill up the depressions. We see water in a hole right after a rain—we put stuff in, and roll it down with a roller. We have got good roads. We come along a tarred road and treat it the same way. We come along to one that is used too much; we cut it off, put it in good shape and roll it down. I've heard a good deal of discussion here; what you want to do is to get your Congressmen together and don't vote for a man unless he will tell you, on the honor of his word, that he will vote for building good roads from one end of the country to another. We have got a good highway commission. I noticed one farmer here; when I was building a road through his district, he didn't want it at that

time. I asked him "Why don't you want it?" He said, "Why, because these here city fellows with automobiles and these joy riders and all these people tear the roads up and we have got to pay for them." Now every farmer along that road has an automobile and wants more roads.

THE CHAIRMAN: The next subject is "Drainage Structures," by Mr. A. R. Hirst.

WATERWAY STRUCTURES

BY A. R. HIRST

State Highway Engineer of Wisconsin

Among the most important considerations affecting the construction of public roads is that of drainage. The life of every road structure depends upon the drainage given it, and the culverts and bridges necessary must be built not only to serve the purpose of drainage, but must serve also the convenience and safety of travel. The failure of a road results only in the additional expense necessary to replace it in proper condition, but the failure of a bridge results also in the suspension of travel, and if it occurs at the wrong moment, may cause considerable loss of property and possibly injury or death to those traveling the road.

For many years both the design and erection of highway bridges was practically entirely in the hands of the steel bridge companies, who used their opportunity to the utmost and decorated the landscape with structures which had little to commend them except the fat prices they brought from an unknowing public.

Within the last few years, however, many States have created highway commissions which have effectually taken up the problem of bridge design and a considerable change for the better has occurred, both in the strength of bridge superstructures and in the foundations, more especially in the latter, which was the place where most of the older structures were especially deficient, if one point of weakness can be selected from the mass of general ineffectiveness.

A properly designed waterway structure should fulfill the following requirements:

1. Waterway sufficient to carry off promptly the water coming to it.
2. Proper foundations to bear the loads, resist undermining, and give long service.
3. Superstructure designed to bear for a long period of years any load which may legally be imposed upon it.
4. Superstructure wide enough and so constructed as to serve the comfort and convenience of travel.
5. Economy of maintenance.

A sixth factor, that of aesthetic design and fitness of the structure to the surroundings, has been and is little considered in bridge and culvert design, but will probably be demanded more and more as public appreciation of the value of pleasing design grows.

In the short compass of this paper we cannot enter into a discussion of bridge design, or give any details of any specific type of structure. We will, however, give some account of our standard practice in the State highway work in Wisconsin, and probably this will be sufficient evidence of our views as to what constitutes a proper waterway structure.

Wisconsin is a State-aid State, and gives State-aid to bridges and culverts as well as to road construction. All waterway structures 6 feet and under in span are classed as culverts, and are built out of the funds available for the construction of the road. All waterway structures over 6 feet in span are considered as bridges and must be provided for by separate appropriations, the State paying 20 per cent of their cost instead of $33\frac{1}{3}$ per cent as in the case of culverts on roads.

Wisconsin has a drastic bridge law which provides that culverts under 18 inches in span must be so constructed or reconstructed as to stand without planking a load of 18 tons, and waterway structures over this span must be designed, "in accordance with standard engineering practice," to stand a load of 15 tons without planking.

In addition to the duty of designing all State-aid bridges and culverts, the State highway commission has imposed upon it by law the duty of approving as to their safety and engineering sufficiency the plans of all bridges constructed with county aid. In the seven seasons of the existence of the Wisconsin highway commission and its predecessor in highway work, the Wisconsin Geological and Natural History Survey, we have designed about 1000 highway bridges of a span exceeding 10 feet for counties, and about 400 bridges exceeding 6 feet in span, and innumerable culverts under this span for the State-aid construction. In addition to this, we have approved the plans for probably 500 bridges not designed by our engineers, but simply checked as to engineering sufficiency. Actual culvert and bridge construction under our own designs has cost about \$2,000,000.

We may roughly divide our bridge superstructures into five classes, as follows:

Class 1. Spans from 18 inches to 10 feet. Almost invariably constructed of reinforced concrete of the slab type. We are building even the smallest culverts of reinforced concrete, as we find in Wisconsin that they are entirely serviceable, easily constructed, and in probably 50 per cent of the cases cost less than any other type of culvert except wood, which is not allowed on any of our work. The smallest concrete structure we are now building is 18 inches by 12 inches, as we have found the smaller sizes equally as expensive and very easily blocked with ice and débris.

In some cases where the foundation conditions are extraordinarily soft and difficult, or concrete materials are not reasonably available, we use culverts of corrugated metal with concrete or stone end walls, but such culverts are used only where it is impracticable to use concrete, and probably not 1 per cent of our culverts are now built of this material. Vitrified clay is not used at all on State-aid work, as they have been found almost invariably to crack by filling and freezing. Concrete pipes molded in place and afterwards moved to the job are not used for the same reason. Under conditions favorable to their use, both make excellent culverts, and we could recommend them in less severe climates. Cast iron water pipe has not been used on account of its cost, which invariably exceeds that of concrete.

We find in the small concrete culverts from 18 inches to 10 feet the average cost per cubic yard complete, including the excavation and backfilling, is about \$8, and very seldom runs above \$10 per cubic yard; sometimes as low as \$6.

Class 2. Spans 10 feet to 40 feet. Either reinforced concrete, the slab type up to 18 feet and the through girder type up to 40 feet, or I-beam structures with concrete floors are used. We are building many true reinforced concrete bridges, but with public lettings open to any bidder, the workmanship and finished appearance has been so poor in many cases that we are using more I-beam structures than we otherwise would. In the case of I-beams, a 5-inch concrete floor is placed on top of the I-beams, and the corrugated arch type of support for the concrete between the I-beams is but seldom used.

Class 3. Spans from 40 to 80 feet. We are using the Warren riveted pony truss practically exclusively, though a few plate girders are being used where the conditions of hauling are favorable. All of these structures have concrete floors.

Class 4. Spans from 80 to 135 feet. We use the riveted Pratt high truss with a horizontal top chord, also with a reinforced concrete floor.

Class 5. Spans over 135 feet. We use a Pratt riveted high truss with a curved top chord. Practically all of these larger spans are also built with a reinforced concrete floor. Very seldom do we use a pin connected truss, either for Class 4 or 5, probably not once in twenty-five cases.

From our cost figures on all bridges so far constructed, we find that for any span the price erected (including substructure and superstructure) figures out very closely to \$40 per linear foot of the overall span. Reinforced concrete floors average about 20 cents per square foot. Steel in plate girder and truss spans averages from \$25 to \$70 a ton erected, and I-beam spans figure from \$50 to \$60 a ton erected.

We have adopted for widths for concrete culverts and bridges the standards recommended by the Association of State Highway Department, which are as follows:

First class roads

	<i>feet</i>
Culverts under 12-foot span, minimum width.....	24
Slab bridges over 12-foot span, minimum width.....	20
All other concrete spans, minimum width	20
Very long bridges less if necessary.	

Second class roads

Culverts less than 12-foot span, minimum width.....	20
Slab bridges over 12-foot span, minimum width.....	18
All other concrete bridges, minimum width.....	18

Third class roads

Culverts less than 12-foot span, minimum width	20
Slab bridges over 12-foot span, minimum width.....	18
Longer bridges may be, minimum width.....	16

Steel bridges are built almost invariably with a 16-foot roadway; that is, 16-foot clear distance between trusses or rails, no matter what the class of road, although for spans under 80 feet some 18-foot clear roadways have been built.

Abutments under practically all structures are plain concrete, as with concrete materials as cheap as we have them in Wisconsin, and with the difficulty of getting first-class workmanship in reinforced concrete foundations without constant inspection, we find that this is the cheapest type of abutment. Occasionally cement rubble masonry abutments are used, and once in many times driven steel I-beam piles surrounded by a concrete wall are used. The last type of abutment has been found to be very satisfactory and economical for high abutments on sandy bottoms, and has largely displaced the use of cylinders with steel backing. Steel backing is not allowed on any State-aid structure. The price of concrete in bridge abutments and piers averaged last year about \$8 per cubic yard.

A large share of the trouble with bridge structures results from improperly designed foundations. A common fault is stopping work before a proper depth below stream bed is reached. Seldom should foundations extend less than 4 feet below stream bed, and whenever doubt as to the bearing power of the soil at that point is entertained or as to undermining from a rapid stream, they should be carried down to solid soil or thoroughly piled. All foundation work should be inspected as the excavation is made and material is placed, not necessarily by an engineer, but at least by an honest man with good judgment and backbone. All concrete work in any part of the structure should be inspected as it is placed. Inspection of steel and workmanship on it as it is erected is not so necessary, as it can be inspected and its compliance with the specifications determined after erection at the time acceptance is to be given.

As to methods of letting the work. We have found it necessary to have open competition and sealed bids on bridge work, and by asking for mailed bids on all work have established true competition and have to a very large extent broken up the old system of "pooling," and combinations of the bridge agents who may be on the ground at

the letting. We furnish complete plans for foundations and for reinforced concrete, I-beam and plate girder spans, and all bidders submit prices on our uniform plans. For truss spans, we furnish the truss diagram showing the stresses in the truss members and the make-up of the truss members, floor system, and principal connections, and the successful bidder submits for approval the shop drawings before fabrication is commenced. For trusses we believe the latter system is preferable to that of furnishing complete shop drawings, as it allows manufacturers to follow their standard shop practice in detailing so long as these details are satisfactory.

The proper design for culverts and bridges is an engineering problem which should always be left to engineers. Probably a State highway department can handle it more economically than can private engineers, as so many bridges will be built of one span that superstructure plans can be standardized and even the same foundation plan may fit several bridges. The cost of designing, letting and accepting bridges in Wisconsin has averaged us about $3\frac{1}{2}$ per cent of the total cost. Inspection has been paid for separately by the local units. It would probably be better to have a State inspector on each bridge, but we have gotten very good results through local inspection at probably 25 per cent of the cost of placing a man on each job. Important jobs should have a skilled inspector by all means.

The above discussion, I am afraid, when I read it over, is not as enlightening as could be desired, but I hope it may be of some interest, and if so, I shall feel repaid for the time taken to prepare it in our very busiest season.

THE CHAIRMAN: The discussion will be opened by Prof. T. H. MacDonald, State highway engineer of Iowa.

MR. MACDONALD: It is so near the noon hour that I do not expect to take advantage of the time allotted for the discussion of the paper, because in the main it represents standard practice throughout the upper Mississippi Valley States. The Association of the State Highway Departments of these States, which has been confined largely to these States, has directed during its meetings for the past several years, its attention to the proper design of bridges and culverts, and these departments all look upon the subject of highway bridge and culvert design from the standpoint of a State-wide proposition. That is, it is not so much a matter of the individual as it is a matter of adopting methods that can be standardized and designs that can be duplicated many times. For instance, all of the standard box culvert designs of the State highway commission of Iowa are duplicated so many times that in place of using an individual blue print for these structures, they are electrotyped and printed by the thousands and when we consider the drainage area of the State, like almost any of the Mississippi Valley States, Iowa I think with 54,000 square miles and under the law the State department

is responsible for the design or for the standard specifications governing the waterways through which all of the water from 54,000 square miles of area must pass, and we have found this to be the case, that in most cases, for the primary structure, those structures for which there is a small tributary area, which have no tributaries themselves, we have found that in most cases the area of waterways for these structures may be made less than is now the case; that is, it has been cheaper, in these States, to build a 16-foot bridge when planks were cut 16 feet long, than it was to cut the planks in two and make it 8 feet long, and so, for the primary structures, using Talbot's formula and blue prints, which we will not take time to discuss here, but which may be used for draining different characters of surfaces, we are cutting down the size of the waterway for all of the primary drainage area, but for all the secondary drainage areas, the inclination is to make these larger and I believe that if we are taught anything by the recent floods which occurred last year, it is that there must be some control of the streams which will provide for all of the secondary drainage areas adequate waterways; and with the limited time at my disposal, there is only one other point I wish to mention and that is the subject of federal patents as related to highway improvement, particularly relative to highway bridge improvements; it is my idea that the federal government should not issue patents for any type of highway improvement for which the government is not willing to take the responsibility. The State of Iowa, after a most careful examination and after the employment of legal advice, patent advice, put on its statute books last year a measure by which the State is empowered in any case in which the governor may think that the interests of the public demand, the State is empowered to intervene and take over the defence of any patent suit relative to highway improvement patents, and the State has already intervened in one such case, and it is my thought that it is necessary to examine the patents that have been issued in order that there will not be fastened upon the bridge industries as related to reinforced concrete designs, any royalty which is not proper, and we have the rather unique position of a State undertaking to defend its right against the federal government, which we have felt was somewhat jeopardized by patents which were issued. I believe the federal government patent officer should be required to take full responsibility for the patents which are issued, so that we will know they are really valid and should be entitled to the respect of all the engineers who wish to use the types of construction that are so patented. I thank you.

THE CHAIRMAN: We will pass over the discussion of this subject for the moment and get the other subjects before us. Next we have on our program the subject of "Brick Roads," which will be discussed by Mr. James M. McCleary, county engineer of Cuyahoga County, Cleveland, Ohio.

BRICK ROAD CONSTRUCTION

BY JAMES M. McCLEARY

Road Engineer, Cuyahoga County, Ohio

The road system of Cuyahoga County has received so much praise that anyone who claims connection with its development incurs danger of the charge of egotism, provided he omits to point out that the much heralded excellence was a gradual growth and that costly mistakes marred the county's early ventures into this realm of improvement. These mistakes were less due to wrong theories or practices of the engineers than to the demand of the taxpayer for a cheap improvement. Couple with this cause the eloquence of the material man who had something to sell that possessed practically no value as a road material. The extraordinary merits lay entirely in the blithe manner and quick tongue with which he persuaded the property owner that if his material were used—and his only—when Gabriel sounded his horn and we all answered that last call it would be clearly evident to said property owner that the Lord Almighty made a serious mistake when he paved his streets with gold and overlooked so valuable a substance as the patented article.

The failures of these various materials I shall not discuss, but shall deal with the mistakes of early brick construction, for it was by these earlier experiences that the present methods of building brick roads in Cuyahoga County were evolved. There was no sudden vault to excellence. We corrected our errors and gradually attained the type of highway which has won your attention. No peculiarities of topography or soil make this kind of road more appropriate in Cuyahoga County than elsewhere. To make this clearer, I will state that in the western part of the county the land is so level that drainage is a difficult problem and must be given much consideration. In the southern and eastern parts, the land is so broken that to secure a feasible grade without undue expense for excavation becomes the chief difficulty. The soil varies from a sticky yellow clay in the southern and eastern sections to a sandy loam at the west. The development of the brick road in Cuyahoga County, therefore, was obstructed by all the possible problems to be found elsewhere: natural and artificial soil, grades, climatic influences and the opinion of the abutting property owner, this latter being always ready of expression at every gathering where road building was considered.

The first brick road in Cuyahoga County was started in 1893 and completed in 1895 and located on what is known as the Wooster Pike in the southwest portion of the county. The wearing surface was of standard size brick, 8 feet in width, tar filled, placed between stone curbs, 3 x 15 inches and resting upon a 6-inch broken stone base. The pavement was placed upon one side of the roadway

with a graded earth drive occupying the balance of the width. No drainage was provided and really nothing of detail was taken into consideration.

The specifications were principally contained in the title on the back of their cover. So far as the contract was concerned, it provided chiefly that the contractor was to be paid in any event. If anything could open the eyes of blind justice, surely it would be this first contract awarded in Cuyahoga County for brick pavement.

No requirement in the specification dealt with the quality of the stone and the result was that the contractor gathered up field stone for his base and they were of such consistency that, when the roller had done its work, one might think that sand ballast had been used. Upon this the cushion was placed without compression and then the brick. As to the filler, no one could have told its composition at the end of six years, so little of it could be found.

The pavement being but 8 feet in width, all of the traffic came in one place. Lack of bond and absence of uniform support, caused a depression to appear. In the wet season, this rut or groove filled with water which soaked through the base, creating a worse condition from day to day during the damp seasons. The colder weather brought upheavals and such havoc that many sections of the improvement (so-called) were a hindrance rather than an aid to the traffic.

I anticipate your query as to why these defects were not repaired. Strange as it may seem the law under which these improvements were made permitted no expenditure for maintenance. In 1898 this legislative flaw was remedied, but for five years there was no chance to palliate the badness of our methods nor to interfere with the increasing dilapidation which constituted the chief value of this road—the value of a horrible example.

The next road laid was South Woodland. This is in the eastern section of the county. Again the wearing surface was 8 feet in width, tar filled and placed between flush stone curbs on a 6-inch broken stone base. We had learned, in a small way, from our first mistakes and placed a 6-inch drainage tile beneath the center of the road way. But on account of the soft filler and imperfect preparation for carrying off the water, but little improvement in the result was realized. An uneven settlement of the base soon resulted in roughness. For all of its shortcomings, however, I wish to state that when it was taken up three years ago to be replaced by a 30-foot roadway, its condition was such that by contrast, not every town or county could point a finger of scorn at it.

Lorain Road, our next installation, was built 16 feet wide, tar filled and resting upon a crushed stone and slag base between flush curbs, with drain tile beneath each curb. Subjected to an unusually heavy traffic, the almost inevitable result of such construction must be extensive repairs amounting almost to reconstruction.

Our next great forward step occurred when the tar filler gave way to a grout filler composed of one part sand and one part cement. This plan was followed until 1905 with success, at least in comparison with previous experiences. The cement filler alone could not cure all of the defects due to inferior drainage and frost action. Another step was therefore decided upon, the inclusion in the specifications of a requirement for a 4-inch concrete foundation which, of course, increased the price. State Road No. 2 was constructed under this plan. The increased cost brought immediate opposition, resulting in a temporary return to broken stone or slag base until 1908 when concrete was again adopted as a foundation and continued up to the present time.

I have gone into these experiences rather extensively for the purpose, as I said before, of showing you that the present method of building brick roads in Cuyahoga County is the result of a slow growth and not fruit of some revelation vouchsafed to an inspired engineer after a Welsh rarebit supper.

Since 1908 it has been the policy not merely to conform to the chief essentials of brick paving, namely, the properly prepared subfoundation, the smoothly finished concrete base, the compressed sand cushion, the laying of good brick, the application of the cement filler to the joints, but to attach importance to minor details of approved manner and method of construction as will produce a road nearly approaching the ideal. I say "nearly" with much emphasis for I feel that in road construction there is always room for improvement. And doubtless we have not even yet given weight to certain details advocated by some of the more painstaking students of brick road construction in the country. Our approach however to the ideal at each successive effort has given to us roads which have received almost a world wide commendation and have given to Cuyahoga County the best road improved district of any like sized area in the world.

A satisfactory plan for an average rural pavement may include a paved portion anywhere from 9 to 16 feet in width, the width being controlled by the amount of traffic to which the road is subjected. A dirt or gravel macadam should occupy the balance or unpaved portion of width. Whatever dimensions are adopted, the surface drainage should be over the pavement toward a ditch on the side of the road closest to the pavement, eliminating a crown from the paved portion. The unpaved portion should be drained in the opposite direction.

Immediately you ask "Why a dirt road?" The best answer is, "Ask the farmer" and he will tell you to ask the horse.

The engineer will save himself much trouble if he holds to such a grade line as will entail minimum depths of fill. This is not always possible and it is the larger fills that call for the most extreme care. It behooves the engineer to see that his specifications contain a

clause calling for the fill to be put in layers of not more than 6-inch thickness and each layer compacted with a roller, not exceeding ten tons in weight. This clause must be enforced with rigidity.

Puddling is the one method that can be followed successfully in the treatment of old fills. The surface of the road should be broken and dirt removed from the center to the sides. At right angles to this trench, shorter trenches should be dug at intervals of twenty-five feet, forming a rectangular vat. Pump water into these compartments and allow it to stand until it has leaked its way into the fill. This will disclose the weak spots and the engineer can take care of them as he thinks best.

The drainage of the graded portion of the road is of first necessity. Whatever plan is adopted, the one that will most nearly maintain the sub-structure free from moisture below the frost line is the ideal condition to be sought. This means that you must not merely drain the road bed, but adequate side ditches must be provided to carry off promptly the accumulated water. In the preparation of a sub-base the only debatable proposition is the purpose of rolling. Common practice, including the use of a very heavy roller, has been founded upon the theory of compacting the soil to as great a depth as possible. This can do no harm but I am personally inclined to believe that the chief purpose of rolling is accomplished when the weak or spouty places in the soil are revealed so that the engineer can treat them as he sees fit.

For this purpose, a roller weighing from eight to ten tons answers every requirement. Preceding the final preparation of the sub-base the curbs must be placed. In case of most of our rural work, curbs are placed flush with the surface of the completed pavement.

With curb set and base prepared the next step is the placement of the concrete base, which with our roads has been 4 inches in depth. In specifying the proportions, a mixture of one-three-five with a permissible variation according to the size of the aggregates which will most nearly fill the voids, meets every necessity. To meet this variableness, which obtains with almost every job, it is necessary to specify the size of your course aggregate, but not the amount, requiring only so much of the course aggregate to be used as shall leave the concrete most nearly free from voids. This, instead of an inflexible rule of proportions, will relieve you of many arguments and will assure you a condition of concrete whereby a smooth surface is easily attained. A smooth surface you must have, for upon that much both of efficiency and durableness of your wearing surface depends. It enables you to accomplish in the next step a requirement of equal importance, that of placing the sand cushion of uniform fill and of uniform density.

While personally I do not place as much importance as some people do in the ability of the sand cushion to afford a resiliency or absorb the shock effect, it is unquestionably a necessity for the purpose of bringing the wearing surface of the brick to a perfect

plane, by neutralizing the unevenness and lack of uniformity of the brick.

No one will question but that the support of the wearing surface provided for by this sand cushion must be uniform. It is therefore necessary to compress and bring to a like density every part of this cushion. Dropping the sand cushion on to the base from dump wagons and leaving the bottom portion of the load untouched before striking off with a template is objectionable and renders the hand rolling difficult by having a dense pile and a loose pile to contend with, the roller spanning the looser portion. It is better to spread the sand entirely by shovels, than by rolling and striking off and re-rolling, even a third time. Thus you bring the cushion to a condition of compactness and even density that not only will furnish an even support to the entire pavement, but will prevent the sand from flowing up into the joints of the brick when the brick surface is rolled. While it is not necessary for this cushion sand to be entirely free from soil and vegetable matter, it should be nearly so, otherwise its density cannot be maintained.

It is needless to go into the specifications for the brick further than to insist on lugs on the side, and grooves on the end of the brick. I do not mean that there should be no specification for the brick but that it is the place of the engineer to determine by the class of traffic in prospect, what percentage of loss shall be tolerated as a maximum in the rattler test. Granting that you are satisfied with your brick, their laying is the next proposition.

1. See that the lugs are turned one way.
2. Make certain that the joints are broken so that one-third or more of the brick of one course overlaps the brick of the next course.
3. Be sure that every fourth course is driven up to a straight line.
4. For the sake of appearance, keep the line of the brick at right angles with the curb.

Next in order is culling. Care should be taken to see that all soft brick or brick that are burned too hard are removed. Those so heavily kiln marked that they will cause unevenness in the pavement should be turned. Caution should be exercised in this, for many a kiln marked brick is thrown out which, if allowed to remain would have been of more value to the pavement than others that are retained.

After the brick are thus placed in the street, their slight unevenness should be ironed out by the use of a roller not exceeding five tons in weight. If a horse roller is used at all, it should have a diameter of at least 5 feet. Rolling should begin on one side and pursue a course parallel to the curb. The roller should return over the same course. The next trip should lap the first, the roller again returning over the same course. This should continue until the center of the pavement has been reached when the roller should be moved to the opposite curb and continue as before until the center is reached from the other side.

The roller should then start at one side and work diagonally across the pavement. This diagonal rolling will have a tendency to bed the brick in such a manner as to avoid "rocker." The pavement should then be culled again for broken brick after which it should be hand rammed with a paver rammer weighing not less than fifty pounds. Interpose a plank not less than 6 feet long, 10 inches wide and 2 inches thick, between the surface of the pavement and the rammer. The plank should be laid parallel to the curb.

For filling joints, the next process in order, use a grout filler composed of equal parts of sand and cement. It seems hardly necessary to state that the cement should meet the standard specifications for Portland cement as adopted by the American Society for Testing Materials. The sand with which we have had much success has been taken from the lake and although not very sharp is nevertheless fine and clean and has given such good results that I cannot do otherwise than recommend its use. In any event the sand to be used should be free from sewage, acid or soil, and should be sharp and fine.

A watertight box, standing on uneven legs so as to afford a "lower corner" should be used as a receptacle for the grout. In it place not to exceed 1 cubic foot of sand and one bag of cement, mixing the mass until it assumes a uniform color. Add water and stir the mixture until it assumes the consistency of thin cream. The mixture should then be applied to the pavement by means of scoop shovels and thoroughly swept into the joints. After this has had sufficient time for setting a second coat, slightly thicker should be applied and later a third coat which will assure filled joints. This last coat should be worked either with a specially prepared broom or a rubber squeegee and swept across the joints at an angle of 45 degrees.

After the initial set has taken place, the pavement should be covered with a half inch or more of sand and this kept saturated with water for at least five days. The pavement should not be opened to traffic for at least ten days.

We have not undertaken any special provision against possible thermal effect, such as contraction and expansion due to low and high temperatures, but have relied mainly upon the condition of our structure by avoiding moisture underneath the roadway and by an endeavor to have our cement-filler at the greatest possible strength. These provisions, together with a rigid curb enables us to hold in compression, the expansion occurring in our narrow roadways. In this respect, we have not been entirely successful. A few cracks in the pavement have appeared, but so far, they have not ravelled out so as to injure the traffic worth of the road and have not been thought of sufficient importance to require repairs.

In trying to express the proven worth of such roads to the community, I am at a loss for words. Their economy has proven in contrast with any other methods of road building from the cheapest to the most expensive. I make this statement after comparing the annual maintenance cost of other types of good road with the utter

lack of any repair expense, on brick roads, due to ordinary wear. Our only repair expense has been caused by early mistakes in construction.

The fact that our roads are in shape for maximum service twelve months in the year and that they originate no dust has endeared them to abutting dwellers and to travelers from a distance. Washing by rain suffices to keep them clean and imparts a sanitary advantage which has been much emphasized by health authorities.

Perhaps the most eloquent praise is contained in the simple statement that, although we have built nearly 400 miles of such roads, thirty-three farmers petitions are now on file in our office, asking for thirty-three separate extensions. Local sentiment may be conservative, but it everlastingly catches on when it is shown something really good. We are no longer besought to make cheap roads, but to make good ones. Witness one case where assessments on a macadam road had still four years to run and yet so eager were the abutting owners for a better road that they threw four years payments into the discard and signed unanimous petition for brick. The petition was granted and brick laid, although it was necessary to scrap a relatively new macadam road to do so.

In a day when power traffic is imposing new tests upon road surfaces, and when the aggregate of all traffic is increasing so rapidly, I cannot avoid the feeling that we were fortunate in wasting little time and expense upon methods that could bring us no ultimate advantage. Our early experiments were often far from successful but they carried us along a course of evolution to something better than we could possibly anticipate. We must credit good luck alone for the fact that our venture dealt with a type of road peculiarly adapted to forms of traffic which could not be foreseen in 1893 when the experiments commenced. We can only claim credit for persistence in building year after year without a single omission for two decades, in refusing to be discouraged by failures and in availing ourselves of the only chance that any man can ask—the chance to correct his own mistakes.

MR. R. KEITH COMPTON: In opening the discussion on brick roads the speaker feels that the construction of brick streets is so interwoven and so closely allied with the road end of the proposition that a few remarks from him concerning the early construction of brick streets in the city of Baltimore might be somewhat interesting for this convention.

I suppose that every community in the early construction of its roads and streets has passed through the same experience as Cuyahoga County. As intimated in Mr. McCleary's very excellent paper, ten or fifteen years ago sales agents, lobbyists and politicians had more voice in the selection of road and streets materials than the engineer. Very frequently the engineer was forced to use against his better judgment either inferior material or material entirely unsuited for the

work which he had to do. Today, however, in almost every community, we find that the selection of the material is in the hands of men trained along lines which place them in a position to decide which is the best material for any particular road or street.

The first brick pavement laid in Baltimore was constructed about 1892 on St. Paul Street between Biddle and Preston Streets. It was laid on 4-inch base of concrete and a sand cushion anywhere from $\frac{1}{2}$ inch to 3 inches in thickness. The brick was about the same size as the ordinary building brick, wire-cut, with straight edges, and of red shale. Instead of laying the courses at right angles to the curb, they were laid herringbone fashion, the most expensive way to lay a pavement. Sand was used as a filler. After giving twenty-one years service, one-half of the block has been renewed; the other half is still in fairly good shape. I cite this to show that even in the early stages of brick construction good and successful work was accomplished, along with failures.

We then came to the re-pressed brick, with lugs, and continued to lay brick of this character in small quantities until 1911, when the city of Baltimore had on its hands about 23 miles of vitrified block—some of poor construction, some fair and some excellent. Since January 1, 1912 to September 1, 1913, we have put under contract about 243,000 square yards, and have completed 182,000 square yards. Some of this work is on very heavy traffic streets, most of it is on medium traffic, while a small portion of it is alley work.

The old section of Baltimore, as many of you gentlemen probably know, contains many small alleys, varying in width from 10 to 20 feet. In the business section of the city these alleys are used for the purpose of delivering goods to the rear of the wholesale houses and warehouses, while in the old residential section they are used principally for the collection of garbage, delivery of ice, etc., so that you will readily see that in the business section it is necessary to have a material which will stand this severe traffic, while in the residential section there is not enough traffic on the alleys to keep a bituminous pavement alive; therefore we feel that brick is probably the best material to use in this instance.

Probably 5 per cent of our brick work so far is on a 4-inch base, with 95 per cent of it on a 6-inch base. We endeavor to follow the very latest and up-to-date construction, which is strictly in accordance with that outlined by Mr. McCleary, as follows:

A PROPERLY PREPARED SUB-FOUNDATION

If the sub-grade is of soft material and spongy under the roller, the contractor is compelled to remove it and substitute good material. The sub-grade is thoroughly rolled with a steam roller weighing not less than 5 tons. If of light sandy material, it is lightly sprinkled with water to prevent creeping under the roller, and also to prevent its absorbing too much water from the concrete.

SMOOTHLY FINISHED CONCRETE BASE

While we do not use a template on finishing out concrete, the contractor is required to make it of such consistency and to ram it in such a way that it presents an even and smooth surface. On a 6-inch concrete base stone passing a $2\frac{1}{2}$ -inch screen, and on a 4-inch base stone passing a $1\frac{1}{2}$ -inch screen is allowed, to the extent of 20 per cent of the total mass, but in no instance must the longest dimension of any stone be over 3 inches and 2 inches, respectively, or one-half the thickness of the concrete base.

COMPRESSED SAND CUSHION

I find that this is one of the hardest things to obtain. Our specifications first called for this cushion to be 2 inches in thickness. We found, however, that there was a tendency for some reason, both on the part of the contractor's foreman and the city's inspector, to exceed this, so that we finally reduced our cushion to $1\frac{1}{2}$ inches, and owing to the smoothness of our concrete there is very little variation from this depth. We find that a $1\frac{1}{2}$ -inch cushion is more easily compacted than a 2-inch cushion, and incidentally, the rolling and compacting of this cushion is one of the most important elements entering into the proper construction of vitrified block pavements, and too much importance cannot be given to the working out of this detail. When your sand cushion is not compact and firm you will find that your grouting is more apt to break and jump out, due to the vibration of the brick under traffic. Furthermore, the rumbling sound so frequently noticed from teams passing over a brick pavement is due in a large measure to your sand cushion not being compact, and for this reason I recommend a loamy sand for this purpose, preferably 10 or 15 per cent of loam, rather than a perfectly clean material.

The most practical way to determine whether or not your sand cushion is sufficiently firm is to step on it evenly but firmly, gradually throwing your entire weight on it. If an imprint is merely made, your cushion is sufficiently firm. If, however, there is a *decided* imprint, your cushion has not been sufficiently compacted, and your men should be compelled to re-roll and re-strike it.

LAYING OF GOOD BRICK

In my judgment what you want is not a very hard brick. If too hard it is brittle, and will spall under traffic. They should be hard, well and uniformly burned, free from warps, fire-cracks and other defects sufficient to cause rejection. What you want in my judgment is uniformity. If you can obtain a uniform brick your street will wear evenly and will always present a good appearance if otherwise well constructed. If your brick are not uniform the wear on your street will not be uniform, no matter how well constructed otherwise.

Blocks when delivered on the street should be unloaded by hand and properly piled along the curb lines where directed.

As outlined by Mr. McCleary, care should be taken in laying brick to see that the lugs are placed all one way; otherwise you will have wide joints on the same line of brick, and your courses will be uneven and wavy.

The breaking of joints as indicated by Mr. McCleary is another very important item, and when cutting brick to fit in next to your curb the cut end should be placed away from the curb rather than against it. You will find that this will give you a street of much better finish. The same thing applies in cutting to fit up against the railway tracks.

In my judgment it is a great mistake to lay the brick too close, although it is also a great mistake to have too loose paving. If laid too close you will not obtain a sufficient amount of grout in your end joints to be of much service. If laid too loose, however, you will find that while rolling the brick will rock and the sand is apt to come up into joints. Incidentally, the sand coming up into the joints is a very important item and should be guarded against to the limit. While your brick are in process of being rolled the inspector should carefully follow the procedure, and if the sand cushion is coming up, the brick should be immediately removed and the sand cushion restruck, and if necessary re-rolled. The appearance of sand in the joints more than $\frac{1}{2}$ inch or $\frac{3}{4}$ inch seriously obstructs the admission of the cement grout.

I know of no better way to roll a brick pavement than that outlined by Mr. McCleary, except that in my judgment the use of a horse-roller is not practicable, but in all instances a steam roller should be used. After your rolling is completed to the satisfaction of the inspector, he should then proceed to look for broken brick and badly shaped or otherwise defective brick which escaped his notice during the process of laying. All of these should be removed, being careful at the same time to remove all chips which have fallen down on the sand cushion, good brick should be substituted, either by recourse to the pile on the sidewalk or by turning such of those in the street which have decided kiln marks on one side. All soft brick which may have previously escaped should be removed. A good way to locate soft brick is during and after the water is applied. They appear dry during the application, or comparatively so, and subsequently wet.

APPLICATION OF THE CEMENT FILLER

The speaker is a firm believer in a cement filled joint rather than a bituminous filled joint for brick pavements. Properly cement filled joints protect the edges of the brick, and give you a monolithic construction. A bituminous filled joint does not protect the edges of the block so well and does not present a monolithic construction. I have seen bituminous filled streets completed in the most workman-

like manner and the street left with a good even surface. Two years later the brick have been rounded on the edges, and the surface has become decidedly uneven, the brick having shifted and floated on account of the bituminous filled joint.

Some years ago we tried a cement filler mixed two of cement to one of sand. We found this too brittle, and at once substituted the regulation filler of one to one. If this filler is mixed and applied as outlined in Mr. McCleary's paper, you should have no trouble, but it is imperative that the minutest detail of the selection of the sand, the cement, the mixing, application, and the covering with sand after the filler is otherwise completed, be complied with. The slightest deviation from one of these details is more than likely to cause you trouble.

It is bad practice to follow too closely the application of the filler with your sand cover. The sand cover can only be used for two purposes: (1) either to protect the cement filler from the hot rays of the sun, or (2) protect it from frost, depending of course upon the time of the year your work is under construction. It is very important that your application be so regulated that two or three hours should elapse between the time that your filler is completed and your sand cover is applied; otherwise, a too early application of your sand will not only cover up slack joints, but may seriously weaken the cement filler.

As is well known, the installation of the transverse expansion joints are unnecessary, the only necessity being the side joints next to the curb. Every precaution should be taken to have those joints free of foreign matter so that your pavements will have, in case of expansion and contraction, the full advantage of a clear joint filled from the top to the bottom with either a good bituminous filler or the patented elastic joint.

For thickness of joint, the speaker finds that the following are about necessary:

- On streets between 30 feet and 50 feet in width, $1\frac{1}{2}$ inches next to the curbs.
- On streets between 20 feet and 30 feet in width, 1 inch next to the curbs.
- On streets between 10 feet and 20 feet in width, $\frac{3}{4}$ inch next to the curbs.

If all of these details are strictly complied with you will have a road or street consisting of the following: (1) durability, (2) ease of traction, (3) moderate maintenance, (4) sanitary, (5) pleasing appearance, (6) it will be a pleasure to either drive or motor over them.

THE CHAIRMAN: I will ask Mr. Blair to continue the discussion of "Brick Roads."

MR. BLAIR: I do not want to take the time of anyone else who wishes to speak on this subject. I think Mr. McCleary deals in detail very carefully as to the progress that has been made in Cuyahoga County in brick road construction. I do not think that even in Cuyahoga County they have reached perhaps that perfection in

construction that is easily attainable, and in spite of the fact that they have reached entire perfection in that county, they have built roads of brick that have not cost, due to wear and tear, anything for maintenance whatever. Some calamity, some little defect in the early construction, has led to the necessity for repairs on a few of the roads, but the system is certainly a wonderful one in view of the fact that it covers a period of twenty years. Many of the roads in that county from ten to fifteen years in use, have not called for any repair whatever. So I think that Mr. McCleary and the commissioners of that county have accomplished really a great work, and it furnishes an example that might readily be copied by a great many communities where the roads in such communities are subject to excessive use and excessive wear, as they are in this county. I am a great believer, myself, in the construction of a brick road on excessively used highways. This Convention, up to this time, has been pretty nearly a discussion of repair and maintenance. I differ somewhat from some of the speakers in that particular, because I believe that we want to arrive at a better information, at better ideas as to how to construct roads of the particular sort that will render service without this dreadful cost of maintenance. I know that what has been said upon this floor is largely from the viewpoint of the speaker. We have heard it said upon this floor by some man from a sand district in North Carolina, that the roads there are wonderful roads and they suit that community. We have heard on the other hand some speakers upon this floor who have praised highly the gravel roads in Missouri. It is from the viewpoint and surroundings of the speaker and it is from a comparative sense that we speak of these roads. The roads that are so highly praised by the gentleman from Missouri would not answer the purposes of many communities in this country, they would not stand up against the tonnage that is raised from 640 acres in the farming districts of central Illinois. They would be all cut to pieces; so I am a firm believer in the selection of road material that is adapted to the community and where we have excessive use of roads and highways, we must build accordingly and we must select the material accordingly, if we would have our system an economic one.

MR. RIGHTER (of New York): I would like to know why the manufacturers cannot furnish a brick that is of less depth than 4 inches. A large part of the cost of brick pavements is the cost of brick, and it seems to me that a brick will have to be designed that is 3 or 3½ inches in depth, so that freight can be reduced. There is a large demand for concrete roads and they are cheap. Brick roads are more expensive. I would like to know if a brick cannot be designed that will bear the traffic and yet be of lighter weight. I have been told by some of the manufacturers that the reason bricks are made 4 inches deep is that the culls can be used in building operations, and that is the reason for making them 4 inches deep

and adding to the cost of freight and handling. I think it is up to the brick companies to furnish a brick that will be lighter.

MR. BLAIR: I may answer that question very much in the same way, following what I have already said. The manufacturers of brick in this country have undertaken to furnish the brick that is best adapted to the uses to which they are likely to be put. We do not believe that it is economic for you as a tax payer or you as an engineer to use a brick that is much less than 4 inches deep. There are certain elements against which the road must be made to bear up and support; these are taken into consideration in the manufacture of a brick 4 inches deep. It is easy enough to manufacture a brick $3\frac{1}{2}$ or $2\frac{1}{2}$ or whatever depth you please, so far as that is concerned, but it has not been a proposition wholly selfish except in the sense that, through self interest, we are giving a brick to the users of brick in this country that we believe is best adapted for the use to which it is to be put and that will best serve the economic idea.

MR. SMITH: I would like to ask the cost of a 16-foot brick pavement on a country road.

MR. McCLEARY: In the western part of the county, grading is a small item, and in the eastern part it is a large item. In a job of 2.6 miles, the grading alone was \$11,000; grading a road 42 feet wide, ditches 2 feet deep.

MR. SMITH: I asked the question to compare it with other figures I have in various parts of the country.

MR. McCLEARY: That is taking care of an expensive road in the eastern part of the county.

MR. BLAIR: I think, eliminating the grade or with a grade at a minimum, through a level country, the cost of a brick road may be said to be approximately \$1000 per foot in width, per mile in length; that is on a 4-inch concrete base such as Mr. McCleary describes in his paper, as being the recent method of building pavements, 9 feet, \$9000; 16 feet, \$16,000, etc.

MR. THORNILEY: In Washington County last year we built a mile of macadam road. The specifications called for two kinds of roads, one of brick and the other concrete. The road that was let was concrete, at a cost of \$12,100 a mile. They did offer brick for the same road, a 16-foot road, at \$16,000 a mile.

THE CHAIRMAN: The next subject is "The Selection of Road Material," by Hon. L. W. Page, Director U. S. Office Public Roads, Washington, D. C.

THE SELECTION OF MATERIALS FOR MACADAM ROADS

BY LOGAN WALLER PAGE

Director U. S. Office of Public Roads

Of all the factors which go to make up the perfect macadam road, there is undoubtedly none more potent than that of the suitability of the material which enters its construction. A road may be located, drained and constructed along the very best lines and according to the most approved methods and be a total failure if the material of which it is built has been poorly chosen. It is perhaps not too much to say that large sums of money are wasted annually in this country because too little importance is attached to this phase of the road problem. The engineer is then, at the very outset, confronted with the important problem of selecting the most suitable material for his work, and on the care with which he performs this task depends in a large degree the success or failure of the road he is to build. The purpose of the present paper is to discuss in some detail the methods which may be used in approaching this problem, with special reference to the value of laboratory tests as an aid in the selection of suitable materials for roads.

There are two ways in which the engineer may avail himself of the information necessary to a proper selection of a road material. The first and only certain one is to make an actual service test on the material under observation, and under the same conditions of traffic and climate to which the proposed road will be subjected. This method is, of course, impractical except in certain rare instances, due to the length of time which must elapse before definite results can be obtained. The second method is, by means of short time laboratory tests to approximate as nearly as possible the destructive agencies to which the material will be subjected on the road, supplementing the knowledge thus gained by a study of the results already obtained in practice on material of a similar nature.

The laboratory testing of road building materials originated in France over forty years ago, and was introduced into this country by the writer in 1893, when he became director of the road material laboratory of the Lawrence Scientific School at Harvard University. The United States government became interested in this work shortly afterwards, establishing, in 1900, a laboratory in the department of agriculture, at Washington. This laboratory is now a part of the office of public roads, and has thus been able to give much assistance throughout the country in regard to the proper selection of material for macadam roads.

The three most important properties which a rock should possess in order that it may successfully resist the destructive agencies to which it is subjected are hardness, toughness, and cementing value.

Hardness, from the road builder's point of view, may be defined

as the resistance which a rock offers to the displacement of its surface particles by friction. It is well illustrated in practice by the grinding action of iron tired vehicles which tend to reduce to dust the rock fragments of which the road is composed. This property is determined in the laboratory by a special method, the essential features of which are as follows:

A core 25 mm. in diameter is drilled from a sample of the solid rock by means of a core drill. After being accurately weighed, it is held in a perpendicular position against a cast steel disc revolving at the rate of thirty-three revolutions per minute, while crushed quartz sand of a standard size is fed upon the disc to act as the abrasive agent. After 1000 revolutions of the disc, the core is again weighed, the loss calculated, and a measure of the hardness of the rock thus obtained.

Toughness, or resistance to impact, is a measure of ability of a road material to resist the pounding action of traffic such as is caused by the shoes of horses, etc. It is determined in the laboratory in the following way:

A cylindrical test specimen of the rock 25 mm. by 25 mm. is taken from the core used in the hardness test, and subjected to the impact of a 2 kgm. hammer through a spherical end plunger in a machine especially designed for the purpose. The test consists of a 1 cm. drop of the hammer for the first blow, followed by an increase in the drop of 1 cm. until failure of the test piece occurs. The height of blow at failure is taken to represent the toughness of the specimen.

The combined effect of the mechanical agencies causing wear is very effectively determined by means of the Deval abrasion test, which has been the standard for over thirty years, and which is conducted essentially as follows:

Five kilograms of the rock to be tested is broken so as to number as nearly as possible fifty pieces, and is placed in an iron cylinder, mounted in such a way that the axis of the cylinder is inclined at an angle of 30 degrees with the axis of rotation of the machine. After 10,000 revolutions of the machine at the rate of thirty-three per minute, the material is taken out and sieved through a 0.16 cm. sieve, the material passing being that used in calculating the percentage of wear.

The cementing value of a road stone is that property which causes the fine rock dust to act as a cement and thus bind the coarser fragments of which the road surface is composed into an impervious shell. A laboratory test to determine this property was devised several years ago by the writer, and is conducted substantially as follows:

Five hundred grams of the material to be tested is broken to about pea size, and placed, together with a sufficient quantity of water, in

an iron ball mill. Five thousand revolutions of the mill reduces the mixture to the consistency of a stiff dough, which is moulded by means of a hydraulic moulding machine into cylindrical briquettes 25 mm. by 25 mm. in size. After drying twenty-four hours, these briquettes are tested by impact in a machine especially designed for the purpose. A 1 kgm. hammer falling upon an intervening plunger, which in turn rests upon the test piece, is allowed to drop from a height of 1 cm. until failure of the specimen occurs. The number of blows causing failure is used to represent the cementing value of the material.

It will readily be seen from the foregoing that a very accurate preliminary idea of the properties of a road stone may be obtained by means of laboratory tests. Many years' experience in testing these materials have made it possible to adopt certain standards of excellence which, when used intelligently and in conjunction with the other factors in the case, are of much value in selecting suitable materials for water-bound roads.

The results of laboratory tests alone, however, are not sufficient to judge of the suitability of a rock for road building purposes, unless supplemented by additional information as to, (1) the character and volume of the traffic to which it is to be subjected; (2) climatic conditions under which it is to be used, and, (3) its name and general character, including, if possible, its mineral composition. In addition to the above, consideration in any specific instance should be given to such matters as the availability of the material, especially with reference to cost, transportation facilities, etc.

The value of taking these factors into consideration will be briefly illustrated below.

It is a well known fact that a given road rock is far from being equally well suited to different traffic conditions. A high grade trap rock would be as unsuitable as it would be uneconomical on a road subjected to light traffic, in that the dust worn off would not be sufficient to bind the coarser fragments together, and the road would consequently ravel. On the other hand, the comparatively soft limestone which would be well adapted for the light traffic road would quickly pound to dust if subjected to conditions which would hardly affect the trap.

As a general rule, it may be said that the ideal rock for any particular road should be just so hard and tough that the fine material worn off by the action of traffic would be sufficient to supply that lost by the physical agencies of wind and rain. By correlating the information obtained by observing the behavior of the various rock types under different traffic conditions, with the results of laboratory tests on material similar in character, it has been found possible to determine quite definitely under just what conditions any given material would be most suitable, even before it had ever been used in road construction.

Many years of observation of the behavior of the various road building rocks in service has demonstrated the fact that, as a general rule, certain classes of material possess for particular purposes distinctive advantages over others. It is obviously of advantage, therefore, to know the general type of the material under observation, in order that an intelligent comparison may be made between it and the material of a similar nature which has already been used. The different varieties of trap, for instance, such as diabase, basalt, etc., are generally considered to make the most satisfactory road material, especially when the traffic is heavy enough to supply by wear the dust lost from natural causes. The limestones, as a class, being softer and less tough are, as a rule, better adapted for light traffic than the traps. Laboratory tests in these cases are, therefore, mostly of value in enabling the engineer to make a definite choice between a number of materials which in a general way might be considered as suitable for his work.

The granites, owing to lack of toughness and cementing value, are, as a rule, only suitable for the foundation courses in plain macadam construction. Here the value of taking into consideration the character of the rock tested may be illustrated by the fact that frequently granites are found by laboratory tests to have good cementing values, due to highly altered minerals, when, as a matter of fact, such material should not be used on account of the ease with which it disintegrates under traffic.

Foliated material, such as gneiss, schist, slate, etc., should never, of course, be used when better material is available. Material such as quartzite and marble should also be avoided, the first on account of its hardness and lack of cementing value, and the second because of its crystalline structure and general lack of durability.

The availability of various materials considered for use in road construction should, of course, be considered, and is highly important, especially from a financial standpoint. In considering this point, however, care should be taken not to lose sight of the other factors in the case. Experience has shown in innumerable instances where poor material has been used because it was cheap that money would have been saved in the long run by the use of a superior rock, even though shipped from a distance and costing considerably more at the outset. There are cases, however, where local material may be used advantageously. It is in such instances as these that engineering judgment, combined with laboratory results, is necessary for proper selection.

An accumulation of data resulting from the great number of tests made on road building rocks in the government laboratory has quite recently made possible some very interesting investigations concerning the relation between the properties of hardness and toughness. By plotting numerous values of these tests, it was found that, in a

general way, hardness increases with toughness and that, whereas for low values of toughness the hardness was extremely variable, as the rock became tougher the hardness showed less and less deviation from an average of the plotted points. The significance of this fact is that the property of hardness appears to be invariably associated with that of toughness, although the reverse is not the case. It seems, therefore, that for a quick determination of the qualities of a road building rock, the hardness test might possibly be omitted, since material which satisfactorily passes the toughness requirement invariably appears to be hard enough for use in road construction.

When rock is to be used in bituminous construction, the importance of some of the above-mentioned tests is diminished. The cementing value, for instance, may be practically disregarded when the use of an artificial binder removes the necessity for dependence upon a dust bond. A tough rock is, of course, preferable, and more especially when the surface is to withstand the shock of heavy traffic, but both toughness and per cent of wear become less important in the body of the road with bituminous construction when the surface is maintained by occasional surface treatments to preserve a wearing mat with a hard and tough aggregate.

Since public health and comfort have universally demanded an abatement of the dust nuisance, and economic maintenance is correlated with their demands, a few words on the selection of dust preventives and road binders can not be out of place in a discussion of materials for macadam roads. The selection of a form of treatment or construction must be governed by a full consideration of the volume and character of traffic which the road surface is called upon to carry. In rural sections where a macadam road is subjected principally to the average farm traffic and a relatively small number of automobiles, a surface which is in good condition at the outset may be economically and satisfactorily maintained by an occasional application of one of the lighter dust laying tars or oils. The purpose in a case of this character is simply to preserve an already good surface by keeping the products of wear saturated with a material that will prevent them from being removed from the road surface. The purpose is readily best accomplished by a product that is not possessed of marked binding qualities—a material that will not pick up nor “ball” when mixed with dust only. Hygroscopic salts and other non-bituminous dust preventive have also served the above purpose successfully where climatic conditions favor their particular characteristics.

The value of a simple dust preventive decreases, however, with an increase in the volume of automobile traffic, and a more permanent form of wearing surface then becomes necessary. Up to a certain limit, and particularly on park roads, this character of traffic is successfully provided for by means of an annual surface treatment of oil or tar covered with cleaned screenings or fine gravel. For cold

surface treatment, the oils which give particular satisfaction are the natural or partially refined products which, through laboratory tests, are shown to consist of low-boiling constituents carrying in solution a relatively high amount of heavy adhesive asphaltic base. For most successful surface treatment, it is essential that an oil shall develop decided adhesive qualities in the residue from the standard volatilization test at 63°C. Tar products should be free from water, and it is believed that their value for surface treatment increases with the decrease in the free carbon content.

When the traffic becomes of such a character and magnitude as to cause a too rapid deterioration of a surface mat, the macadam must be constructed or resurfaced with a heavy binder as an integral part of the upper 2 or 3 inches of the wearing surface. The selection of a binder, whether it be a tar or asphalt product, now becomes dependent on several factors, among which the method of construction, character of the aggregate, and climatic conditions are most important. For instance, a dense aggregate may permit of the use of a lighter tar than will a poorly graded one; or a lighter tar or softer asphalt product would be specified for northern latitudes rather than for use in the south. A single standard for all materials and conditions can not, therefore, be established, but with the various factors in mind, a specification can be drawn to cover the consistency and desirable chemical characteristics. In fact, in the purchase of road materials for whatever purpose it should be to the advantage of the producer as well as a protection to the consumer, that a definite specification be required. All shipments when received should be submitted to laboratory tests that will insure fulfillment of these specifications.

THE CHAIRMAN: Has anyone of you any question you wish to ask Mr. Page? If not, I desire to introduce to you Judge Joseph Asher, of Arkansas, who will address us a few moments.

ADDRESS BY JUDGE JOSEPH ASHER

I come from the great State of Arkansas which is pretty nearly square in shape and 54,000 square miles in area. It is the land of tall trees, cotton, corn, rice, fruits of every kind, stone of every kind, coal and diamonds; we have all of these things, and at the same time we would like to have good roads. The constitution of 1874 forbid the county or State to issue any interest bearing bonds, hence we cannot borrow any money for internal improvements of any kind, but the Good Roads' people, about twelve years ago, got together and passed an amendment to our constitution which authorized the voters every two years to vote on the subject of levying a

3 mill road tax, and since then we are progressing in road building. Every two years the question is submitted to the voters and carries by large majority. The country boy appreciates the fact that in case he does not vote the road tax, he works ten days on the country road; in case he does he only works four. You understand we have no cities in Arkansas like you have here, we have only \$500,000,000 valuation and a 3 mill tax on that gives us \$1,500,000 a year. We found out that the constitution did not limit us on an improvement district, and three or four years ago, our legislature passed a law that we might form improvement districts in the country the same as they do in the city, and assess the benefits against the abutting acreage property, and under that law Pulaski County has put down about 30 miles of macadam road, besides 140 miles built without this assistance. The improvement district usually laid out is a territory about 2 miles on each side of the road to be improved on the request of the people living in that territory, representing a majority of the assessed value who signed the petition. The county out of its general fund pays one-third to one-half of the expense, abutting property pays the rest. We found that it worked like a charm. We are coming along and building good roads without much trouble. The people have a lot of interest in it, as it is largely at their personal expense. When they find they are paying something like \$4000 or \$5000 a mile, they are ready to take hold of it; not a man grumbles. We assess them according to the benefits. The county court appoints a board of commissioners, they appoint assessors and they meet and say "We are going to assess the benefits for building this road; come and meet us and see that we do each property owner right, or show us that we are wrong and we will right it." We assess the land in bottom river country, where the land is rich, \$2.50 to \$7 an acre for that road. Everybody is satisfied. Another law under which the legislature may form special improvement districts if the legislature finds it will accrue to the benefit of the country is also in operation. The last legislature put itself on record and put through 200 miles of first class road. Some of that road will be the same as you have in Wayne County, concrete road; another portion of the road is a good macadam. We believe that the fairest way to assess the road proposition is that the people who use the road pay for it, and it is working entirely satisfactory. We have no trouble organizing those improvement districts. The only trouble is that much of our territory is not assessed high enough to sustain a large assessment. I believe that these suggestions might work in some other locality; other States. It is new with us. Our courts have held it good and I believe it would hold good in other Southern States that are similarly encumbered as ours.

THE CHAIRMAN: Gentlemen of the Convention, I desire to read to you a telegram which I have just received from President Dell

M. Potter, of the Southern National Highway Association, whose home is in Arizona. On behalf of the Southern National Highway Association he extends to you greetings and wishes you success in all your undertakings, and regrets that he is unable to be present.

Adjourned until 2.30 p.m.

CONTRACT SESSION

UNDER AUSPICES AMERICAN SOCIETY OF ENGINEERING CONTRACTORS

October 1, 2.30 p.m.

J. R. WEMLINGER, Chairman

THE CHAIRMAN: The meeting will please come to order. Mr. Rickey has a resolution to offer and I will ask him to read it.

Mr. Rickey offered a resolution favoring the creation of a department of public highways which was referred to the committee on resolutions.

THE CHAIRMAN: Mr. W. L. Bowman will present a paper on "Legal Suggestions Respecting Road Contracts."

LEGAL SUGGESTIONS RESPECTING ROAD CONTRACTS

BY WILLIAM LAW BOWMAN, C.E., LL.B.

New York Bar

Etymologically and technically the word "contract" should mean an agreement enforceable by law. "The law of contract may be described as an endeavor of the State . . . to establish a positive sanction for the expectation of good faith which has grown up in the mutual dealings of men of average rightmindedness." How do our present public contracts for road construction and their interpretation by officials satisfy these old definitions. As a part of the great work of properly linking our States and their cities and towns with uniformly good roads, it is incumbent upon us to better and if possible make uniform the contract conditions respecting the construction work and to secure that coöperation and esprit-de-corps between officials, engineers and contractors which alone will give us the best roads for the least money with a minimum of trouble and wasted energy. It has been wisely remarked that "you get only what you pay for" and in the long run that is as true in road construction work as in any other field.

Let us first consider some general principles respecting states, municipalities and roads which should be known in order to appreciate the special subjects which will be considered.

The State is a sovereign body and as such is not responsible by action at law or in equity. There are a few isolated cases holding that when a State goes outside its governmental capacity, it may then be sued in the federal court. No dependence however can be

placed upon these decisions by a contractor. The result is that a contractor with a State has no way to enforce his contract rights nor to secure redress against official oppression unless the State legislature has provided therefor. The best and usual plan is the formation by the legislature of a court or board of claims to hear and determine claims against the State, its departments and boards. One State allows a contractor to sue it provided the legislature passes a special bill for the specific matter. The value of that right is well illustrated by a statement made to the writer by an offending official that when he got through with the matter I would have to have more political influence than he thought I had in order to get such a bill through the legislature. It is also the general rule that in such instances the offending official himself is beyond the legal reach of the contractor. Thus it is that except in those States having a court or board of claims, official oppression and even financial ruin can be honestly or dishonestly caused without any hope or prevention or redress for the contractor. A so-called agreement where the contractor depends solely upon the action of an official and his engineer should not be called a contract. It violates the true meaning and our understanding of that term. This inability of a contractor to enforce his contract rights or even to demand fair play and justice cannot but be detrimental to good economical road construction. Under such circumstances the work becomes political—only favorites dare bid or accept contracts—and the other results of political work naturally follow.

Due to this fact that most States could not and still cannot be compelled to live up to their contract conditions, the terms of a State contract have been considered practically unimportant by the contractor. He knew that he must follow the directions, the plans and specifications called for. While conscientious and honest officials and engineers predominate in State work yet they at times need the restraint which a chance to be heard by the contractor affords. Furthermore the atmosphere and the mental attitude of all concerned is bad in such a situation. Those opposed to granting the contractor this right to properly and legally present his claims before a disinterested court or party will be interested to know that even so great a sovereign as Emperor William of Germany last year lost an action to one of his tenants in the German supreme court over the value of certain improvements. Therefore unless a State has a board or court of claims open at all times to those contracting with the State, its departments and boards, or unless it provides for a submission to an impartial and disinterested arbitrator or arbitrators any changes in the present State contracts that are discussed or suggested will of course be useless except as they may influence the controlling official. In this connection it has been very noticeable that both the judges and the juries favor the State or municipality when they are sued. This is even found where it is necessary to construe the iron-clad terms and conditions of our present day one-sided agreements which

are required to be signed by those desiring to engage in public work and where it would be expected there would be some sympathy for the contractor. In all seriousness then, it is submitted that there seems to be no logical reason why the contractor should not be given an opportunity to get a square deal if he believes he is not being fairly or honestly dealt with.

Municipalities are the legal creatures of the legislature, and their powers and rights must be found in the law creating them. Throughout this paper the term municipalities will signify cities, counties, towns, boroughs, road districts, etc. As a governmental agent, a municipality is immune in respect to mere errors of judgment but in its ministerial capacity it is liable for consequences of negligence and maladministration. As regards plans for public improvements some courts attribute negligence to a municipality in the adoption of a defective plan and the test of the liability of a municipality which causes injury is not the fitness of the engineer but the efficiency of the work. Where a defective plan is the result of bad faith or oppression or is so clearly unreasonable as to inflict needless injury a court may enjoin performance or if the work is completed hold the municipality responsible.

Roads are in the control of the State. In doing road work a municipality acts as the agent of the State performing a public duty imposed by law. On this account those dealing with either roads or municipalities must ascertain the legislative acts pertaining thereto as a basis for any serious investigation. In determining the powers or rights conferred by such statutes the investigator must remember that the wording of the law will be strictly adhered to and that the tendency is to restrict powers granted and to deny any implied powers or rights.

Since a contract may be either wholly void or voidable at the option of the State or municipality unless certain preliminary steps are properly taken and since in such instances it usually results in a total or partial loss to the contractor of his compensation for work done and material furnished it is essential that a brief warning in this regard should be given.

With respect to roads; the proceedings to acquire the land; the report upon the advisability of a road; the estimate of the cost; the description of the road; the survey and resurvey; the proper sanction of the voters or taxpayers; the proper formation and action of the boards or courts, etc., all must be in compliance with the statutes and laws pertaining thereto. In addition the actual preliminaries to the contract itself must be regularly and legally complied with: A proper and sufficient appropriation or available funds; a proper advertisement for bidders; a proper letting to a proper party; a properly constituted board or official acting strictly in accordance with its or his authority; a proper bond for performance, etc. The contract itself must be in the required form properly executed, for the purposes allowed by the special statute, with proper persons en-

titled both to give and to have such contract and in accordance and in conformity with the preliminary reports, plans, specifications, survey, description, etc. As has been previously stated, failures, omissions, or negligence on the part of any of the State or municipal officials or agents in the above respects may cause the contractor to lose his compensation for work done and for benefits actually conferred by the contractor. There are some decisions and some statutes which are based on equity to prevent such unjust enrichment of such bodies at the expense of a contractor but it is not safe to rely on such law in any particular instance. The general rule may be likened to the ancient rule of "caveat emptor" or as it might be expressed here "let the contractor beware." This warning, while primarily for the contractor should be taken to heart by the official who is trying to do right and be honest since usually he is the unfortunate party that causes the contractor's troubles and losses.

CONTRACTS

As we have already seen, most present day state contracts for road construction are not really "contracts" because of the inability of the contractor to sue thereon. In addition I have also seen one State contract which stated that "all right or rights of any action at law or in equity under or by virtue of this contract and all matter connected with it and relative to the same are hereby expressly waived by the contractor." Practically the same result is accomplished by other States and especially by municipalities by the requirement that upon or before final payment the contractor must execute a release in full of all claims arising out of or by reason of the work done and material furnished under the contracts. Is this *good faith* in the dealings of men of average right-mindedness? I cannot conceive of but one answer to this question. The remedy is then simple. Provide either fair and disinterested boards of arbitration to pass upon a contractor's claims or provide a court of claims and eliminate any waiver of appeal to such arbitrators or court and the general release as a condition precedent to final payment from all road construction contracts. In other words give the contractor a chance for a square deal upon a two-sided mutually agreeable contract. In passing it might be noted that the United States government is probably the worst offender in this matter of unfair and objectionable clauses, including that requiring a release, and it is setting a disgraceful example for the States and municipalities.

SATISFACTION CLAUSES

It is probably a safe statement that there is no State or municipal contract in use today which does not provide for the "satisfaction" of some official, board or engineer, or all combined. Is this a necessary, fair and honest requirement in road construction contracts or

is it merely a club to compel the contractor to do what the official or engineer wants regardless of the plans and specifications?

In most States it has been properly held that this requirement merely necessitates work satisfactory to the mind of a reasonable man. Thus if the work has been performed substantially in compliance with the contract, the law will hold the official, engineer, etc., to be satisfied. With plans and specifications so clear and concise as they generally are in road construction, and especially with the work required to be done "under the direction" of an engineer and under constant inspection, it would seem that legal satisfaction would be presumed in 99 out of 100 cases and hence the use made of this requirement in such States would be merely to bluff or bulldoze the contractor. In no way does it improve the requirements of the plans and specifications.

In such a State as Pennsylvania where work can be held unsatisfactory by the official or engineer even though the plans and specifications are rigidly adhered to and where only honesty of purpose is required, the result of such a contract requirement may be heart-breaking. Under the guise of dissatisfaction I have known an official in that State to deliberately violate every essential provision of an agreement and to settle at his own figure with the contractor; or in plain English to rob the contractor not only of his contract right but also of thousands in money with no redress. A contractor who accepts State work in a State where this personal satisfaction of private taste in road construction is required must understand that he is at the beck and call of the official or engineer regardless of his contract requirements and conditions. What could the contractor in such a State do when he has to satisfy not only the engineer in charge, but the road commission and a State board? Suppose the work satisfied one and not the other two, or two and not the third party?

Our considerations recommend that "satisfactory" requirements be dropped from road construction contracts as either unnecessary, harmful or unfair and as not being a sanction for the expectation of good faith between men of average right-mindedness.

CONTRACT WORK

In looking over many of the latest forms of road construction contracts it is noticeable that there is a very decided improvement in the manner and method of setting forth the contract work and specifying what is variously designated as alteration, additional, miscellaneous, or extra work, etc. Road work is now generally specified in various units and a price bid for each respective unit. In one such contract we find this definition: "Extra work is any work in connection with the execution or completion of the contract for which no price is included in the proposal sheets and contracts." Compare this simple and concise statement with a New York City form which had different requirements for ordering additional work as differenti-

ated from extra work, the distinction not being stated and being such that there would be times when the average engineer or contractor would not know to which class the work belonged to. Result—the contractor would be refused payment for additional work done pursuant to extra work requirements or vice.

In this same regard why should a contractor, as is now frequently demanded, be responsible for unknown or underground conditions? Just lately in New York City a paving contractor found a lot of rock above grade which should have been taken out by a prior grading contractor. Under notice to bidders to examine the site, etc., the court of appeals held that the plans of the completed grading contract on file in the city offices did not constitute a representation to bidders of the condition of the road bed and hence the paving contractor had to do this work of grading without extra compensation.

Let us then have definite contract units of work at unit payments clearly specified, and provide payment for any other work necessary which may arise either at the unit prices or, as is becoming popular, upon a percentage basis. This latter method seems a fair means of providing for extra work as hereinbefore defined but the contract must specify exactly what is to be considered the "cost" upon which the percentage is based, as there is great difference of opinion on the subject. For example in one State, the statute provides for certain construction work at cost plus 15 per cent. There being no provision against subletting, the actual work was done by subcontractors at a fixed price. The "cost," as sustained by the highest court, included the cost to the contractor for the work as agreed and paid to the subcontractor, the contractor's overhead expenses for supervision, engineering, office rent, etc. In this way the State actually paid 53½ per cent on the actual cost of labor and materials at the job which is the popular conception of the word "cost" in percentage contracts. The rules of law applicable to percentage contracts are the same as those of the ordinary lump sum contracts. Under proper contract conditions with definite plans and specifications and with honest officials and contractors, contracts on the percentage basis of "cost of labor and materials at the job" would in my opinion give as wide scope for competitive bidding and should give better results in actual construction work. It should do away with many of the conflicts now common between the official, the engineer or both and the contractor. The tendency would also be to give closer competition between the large corporation with heavy overhead charges and the small concern with practically no such expenses. There would seem to be no question but what in the long run this would be less expensive to the municipality because it would tend to cut out the contracts with enormous profits and at the same time lessen the broken contracts because no contract should be given out for less than the defined "cost" price. This is merely a suggestion in passing but I should like to see it given a fair trial.

DUTIES OF THE ENGINEER

Under most of our road construction contracts the engineer takes his time honored dual capacity of agent for the State or municipality and arbitrator between the contracting parties. It has been noted that if the contract provides that the engineer will make an estimate and issue a certificate he will often do so where he may refuse if such wording is not used. There is no question but what the engineer is given too much "discretion" under our present contracts. In road construction work there would seem to be no excuse for a lack of definite plans and specifications which of themselves should reduce the engineer's discretion to a minimum.

There always will be objections to the salaried or paid engineer of a State or municipality acting as an arbitrator without appeal as is the result accomplished by practically all State and municipal contracts. Upon the wording of such contracts some courts have even gone to the extent of holding the contractor but not the State or municipality bound by the engineer's decisions within the scope of his authority. Clearly such a result is unjust. In addition to this, State and municipal contracts are so replete with oppressive or "club" clauses for the engineer that a contractor knows he must take care of that official one way or another. It has been well said that no man should be placed in such a position where bribery and graft is often the easiest and cheapest solution of differences or disputes. Whether or not the engineer is an arbitrator depends upon the strict wording of the pertinent clauses of the contract. All such clauses will be strictly considered and no implied powers will be given the engineer. Where an engineer is made an arbitrator he must remember that he has greater powers than the judges on the bench, because he may intentionally decide contrary to the law and still have his judgment stand. On this account an engineer's decisions should be beyond reproach. The fact that in the exercise of his duties as arbitrator he cannot be held legally responsible for lack of skill, carelessness and even negligence should create an ambition to merit the honor bestowed. The engineer should never forget that he is, under present-day clauses, taking the place of the court and that his action may close the door to either party to appeal from his decision. Professional honor and reputation often depends more upon the engineer's action in such matters than upon his pure engineering knowledge. However, the engineer must know that he cannot ordinarily deprive the contractor of his right to judicial construction of the contract after it has been performed so far as such construction involves matters of law. These considerations show us that the engineer holds under our present day construction contracts an almost impossible position for a human being. Would it not be better to relieve him of some of these onerous duties? Experience seems to show that better feeling, better work, and coöperation between the engineer and contractor may be secured by more precise, concise and definite plans and specifications, and the elimination of all unnecessary "discretion" and "arbitration without appeal" clauses respecting the engineer.

CONSTRUCTION OF CONTRACTS

Since we cannot expect any sudden change in present road construction contracts, this paper would not be complete without a statement of some of the most general legal principles which should govern the actions of officials and engineers even if the contractor cannot sue or get a fair hearing for his side. Since all State and municipal contracts emanate from the contracting official the ordinary rule is that the contract provisions should be construed most strongly against the author. Especially is that so when such construction is necessary to save a contractor from fraud and injustice, or where, as in these contracts, one party is at the mercy of the other. The following instances where municipalities have been held responsible in damages on account of the actions and orders of officials and engineers should be known and avoided:

a. Mistakes in lines, grades, elevations, plans or specifications or directions whereby the contractor had either to do additional work or do over work already done.

b. Requirement that the contractor do the work in a way not called for by the contract, entailing more expensive work than would customarily or otherwise be entailed.

c. Requirement that the contractor do over work already done properly or repair or maintain the same unreasonably.

d. Requirement that the contractor do work not within his contract as contract work.

e. Refusal to permit contractor to perform work called for by his contract.

A substantial performance of a contract creates a situation where the contractor is entitled to his full contract price less the expense of supplying the omissions and defects. From a study of cases all over the country the following rule would seem practical for contracts under \$25,000. Provided the contractor has honestly attempted to complete his contract, and particularly when he has followed the directions of the official or engineer, and when the omissions or defects do not pervade the whole work or make the object of the parties impossible or difficult of accomplishment, or when the usefulness or value of the construction is not materially impaired, and provided the cost or reasonable value of correcting such defects or omissions does not exceed 6 per cent of the contract price, then there has been a substantial performance. No practical working rule can be given for contracts over \$25,000. Substantial performance also excuses the production of an engineer's certificate.

In this connection it is important to note that in correcting defects, supplying omissions or completing a contract the State or municipality becomes bound by the terms of the contract and its plans and specifications. For example, if the contract permitted the use of native stone the State cannot use trap rock and expect to charge that against the contractor. In such instances a burden is imposed upon the official to complete the performance in good faith pursuant to all the contract provisions and with reasonable care and regard to

the rights of the contractor. There seems to be a tendency on the part of some officials to make an example of a contractor who has defaulted. Their chief object often seems to be to spend all the retains and if possible all they think they can collect on the contractor's bond. This is neither legal nor honest. The completion work must be done diligently, and the damages mitigated as much as possible. High-priced men cannot be used for cheap labor, nor can completion be delayed until market prices have risen. Thus it has even been held that a municipality was bound by the date of completion when it assumed a contract.

If a contract calls for liquidated damages for delay after a specified date, such damages are waived or are not recoverable by the State or municipality where they render the contract incapable of performance within the specified time or where they assume as agents of the contractor to complete the contract. Similarly if the delay after a specified date is caused, both by the State or municipality and the contractor, the liquidated damages cannot be apportioned. It has been held that a city cannot retain a substantial sum under the guise of liquidated damages for delay when in fact only nominal damages have been sustained. Where the liquidated damage clause falls, then actual damages caused by the contractor must be proved as an offset. There is still one very important matter pertinent in this respect. Where a contractor follows detailed plans and specifications and the directions of the engineer and completes any part or all the work there should be no deductions for variations from the contract since the parties have practically construed the contract as one for work in accordance with the engineer's directions and such construction must prevail over the literal meaning of the contract. Also under these same conditions and circumstances a contractor is not responsible for a result nor is he responsible for any defects or repairs (except where there is a repair clause) beyond those required by the failure of the contractor's materials or by the contractor's own work. In other words, a road contractor usually does not warrant the road as capable of standing any particular traffic, etc., that should be determined by the plans and specifications.

Naturally the most important thing to the contractor is prompt payment, not only of his partial but also of his final payment. It is a general rule of law that a failure of a State or municipality to pay an instalment on the due date causes a breach of contract which relieves the contractor from further performance and enables him to collect the contract price or reasonable value of all work done to date. The failure of the engineer to make his estimate and issue his certificate may not excuse a failure to pay partial payments even if they are required to be made only upon engineer's certificates. The refusal of an engineer, under ordinary circumstances where there has been work done, to make his estimate and issue his certificate in time so that the contract payment can be made is of itself presumptively fraudulent. Again it is often found to be the case that the

engineer refuses to act upon the direction of the official, which, of course, is collusion, and which excuses the production of such certificate. It is a rule of law that an engineer's certificate will not be considered as a condition precedent to a partial or final payment unless it is definitely and distinctly stated so to be in the contract. The control of the money bag is often supreme and in this way engineers and officials have it in their power to make or break a contractor. A reputation of an engineer for prompt and fair estimates and of an official for prompt payments is sure to result in lower bids and better construction work.

Having considered these few most important matters and with an understanding of the legal principles involved cannot we in the future have justice and equity and not vengeance, spite or bossism in road construction work? The result of such a change, where it is necessary, cannot but be beneficial to all concerned.

REPAIRS

There seems to be a tendency in some of the present day road contracts to require a contractor to maintain the road for a specified length of time, usually one to five years. Is that a good and economical requirement? Does it not to a certain extent restrict bidding and contracting to local parties? Are not the unit prices and hence the contract total largely increased to take care of an unknown amount of repairs? Is there not a gamble on that matter? The best of roads require constant inspection and repairing to keep them in shape. That work should be done either under a strictly repair contract or by the State or municipality itself. This criticism of course is more applicable to country roads as differentiated from city streets.

SUMMARY

In a late article of mine advising architects respecting employment by State or municipalities the following rules were formulated which would seem pertinent here:

1. Know that the municipal corporation is acting pursuant to the law creating it.
2. Know that your contract does not cause the indebtedness of the municipality to exceed its constitutional or statutory limit.
3. Know that your contract does not exceed a limit above which advertisement and acceptance of the lowest bidder is required or that proper advertising, awarding, etc., has been done.
4. Know that assessments or taxes to pay for public improvement work which include your compensation are valid.
5. Know that the board or official employing you do so in the proper legal method required by the act incorporating the body or by the charter or by the local rules governing such body.
6. Know that funds are available or a specific appropriation made by the proper authorities to pay you before proceeding with your contract work.

7. Have your contract in writing and know that it is worded properly.

8. Have and put everything in writing and act only upon the strict wording of all contracts.

9. In State work ascertain first if there is a State board or court of claims; if not you must depend on the official honesty and integrity of the official with whom you deal. Remember personal honesty and official honesty are contradictions in some officials.

10. Never consider or do any public work without first consulting competent legal advice.

While the above advice for the contractor will give him some knowledge of his position in a road contract, yet it does not protect him from the many abuses now possible under such contracts. Those must be corrected by honest, conscientious officials who will countenance only the same character of engineers. Contracts and general specification conditions for road work must be drawn solely for that class of work and not copied slavishly from ancient documents used for buildings, etc. There must be no discrepancy between the contract clauses and the general conditions or other parts of the specifications. Unit prices for unit quantities of specified work with full details in the plans and specifications or cost plus percentage contracts for definite work with opportunities for honest, competitive bidding and awards to lowest bidders are essential. All unnecessary "satisfaction," "discretion," "warranty," "final and conclusive decision," "waiver of damages," "waiver of claims," "waiver of right of action," etc., clauses and other similar oppressive or "club" clauses for the official and engineer must be eliminated. They certainly are anything but a sanction for the expectation of good faith in the mutual dealings of men of average right-mindedness. Lastly and most important the agreement between the parties must be made a real contract by giving the contractor the power to assert and prove his claims before a competent court or board.

THE CHAIRMAN: The discussion of Mr. Bowman's paper will begin by presenting a paper by Mr. James A. Head, who was formerly mayor of Nashville, Tennessee. I regret to say that Mr. Head, on account of illness, was unable to attend, but we are fortunate in having the paper read by Mr. Kenyon, president of the highway commission of Indiana. Mr. Kenyon.

MR. KENYON: Mr. Head sent me a telegram and asked me if I would read this paper for him, which was a little discussion of some of the legal problems that arise in these matters, and as an addenda to the very excellent discussion you have just listened to.

MUNICIPAL CONTRACT LAW AS APPLIED TO ROAD CONSTRUCTION

BY JAMES M. HEAD

Ex-Mayor of Nashville, Tennessee

The building of good roads by the federal government, by the several States and by counties and cities is fast becoming, if it is not already the topic of chief interest to the great mass of the American people. The general law upon this subject is growing, expanding and developing to meet the conditions with which it is rapidly being confronted.

The *Law Merchant* of the common law (which is nothing more than the usages and customs of business reduced to practice soon to be enacted into statute law as the highest expression of public sentiment the real court of last resort as to all law) is fast forcing intelligent action upon this most important subject.

Originally it was thought to be and doubtless was sufficient to meet the conditions then existing to "summons" or "warm in" the neighbors on each road to appear on a given day and devote a specified time to "working the roads." As cities multiplied and developed, this primitive method (which I am sorry to say is still in force in some sections of the country) was found to be wholly inadequate to meet these conditions, and the principal streets of the several towns had to be improved out of the general funds raised by taxation. The growth of towns became so rapid that enterprising individuals soon found that improved streets, sewers, gas and water privileges not only enhanced the general value of property in the towns but actually increased the market value of the property adjacent to the improvement so that the policy of making local assessments against the abutting property to cover a portion or all of the expenses for making the improvements has come to be one of the recognized and established policies of modern law as applied to city improvements, and is now in some sections seriously being considered as properly applicable to country road construction.

This growth of the law and the changes which have taken place within the past few years have necessarily resulted in more or less serious trouble with legislatures, and have produced complicated legal controversies, resulting in more or less serious difficulties both to the contractor and abutting property owners.

Assuming that the broad position is well established, both in law and in public opinion, that abutting property owners may legally be assessed to pay for public improvements at least to the extent of the benefits actually received by reason of the improvement, the law applicable to such proceedings, the method of procedure, and the rights and obligations of the contractor and property owner respectively are still in a more or less unsettled condition in some

places, different policies being pursued in different sections of the country.

The first tendency of the courts was to hold all statutes prescribing the method to be pursued to render abutting property liable for special or local assessments to be in derogation of the common law principle of the equality of taxation, that all such statutes must be strictly construed, and that the liability of property owner for this tax (if such it may be called) was to be set aside unless the exact method pointed out by the statute had been strictly complied with. While this strict construction policy has been practically abandoned and all such statutes are now given by the courts, if not a liberal at least a reasonably fair interpretation, we are still often confronted with the most unexpected interpretations of such statutes.

It is to be hoped that we will soon have no more decisions relieving abutting property owners from all liability for their assessments because as in one case the publication required by the statute that notice of the proposed improvement should be published for so many weeks prior to advertisement for bids and that the requisite number of days had not elapsed by one or two days; or, in another case where the notice required that the advertisement should be made at each end of the proposed work in letters two inches large, whereas the notice as actually published was made with letters only $1\frac{1}{2}$ inches large; or in a more recent case where the ordinance described the property proposed to be assessed as being situated in lot C, when in fact it was actually situated in lot 6.

Such decisions only illustrate the importance of having not only the ordinance of intention to improve, the advertisement, the ordinance making the improvement, and the contract itself to follow both the letters and spirit of the local assessment statute and thereby avoid all possible litigation of this character, resulting either in defeating the collection of the amount due the contractor altogether, or else in casting the entire burden of making the improvement upon the city at large.

The occasional practice of dishonest public officials in awarding contracts for such improvements to favored contractors at exorbitant prices, sometimes shared in by the officials themselves, has led the courts and legislatures to look for some remedy to prevent such flagrant abuses of power and thus no doubt has often resulted in the strained and unnatural construction to which such statutes have been subjected. It was naturally assumed and is still believed by many that competitive bidding in the letting of all public contracts would automatically prevent this corrupt abuse of power, and hence the construction that anything which tended to interfere or which could be construed as interfering with the freest and fullest competition must be held illegal and as expressly prohibited by the statute requiring competitive bidding. It was of course self-evident that the adoption of plans and specifications calling for one kind of improvement, where there were several different kinds that would

answer the same general purpose, necessarily resulted in the restriction or limitation of bidding to those bidders who could or who were prepared to furnish the particular kind of improvement specified. As the adoption of some plans and specifications were absolutely necessary before a public improvement could be advertised for or let by public contract, it was at first assumed that patented or monopolized articles could not be purchased at all by public officials where contracts were to be let to the lowest bidder after advertisement. But this narrow and restricted construction of the statute, which necessarily resulted in prohibiting the use of what might be the very best and cheapest for the purpose desired, has given way to the now generally recognized doctrine of the right of public officials to specify patented or monopolized articles where a reasonable price at which any contractor may purchase the monopolized article is given and no allegation or proof of actual fraud is made. It is in fact being recognized that because so called competitive bidding can be and often is evaded, municipalities should not be deprived by law of the right to use the best that can be had, whether monopolized or not, and that the selection of honest, competent and efficient public officials is at last the only sure way to prevent collusion and fraud. With honest officials capable of forming an intelligent opinion of what is needed and what is best, and the adoption of definite specifications required to be lived up to, satisfactory results always can be attained whether or not monopolized article be used.

The doctrine laid down by some of the courts that the specific method prescribed by the statute for making local assessments must not only be literally followed, but is at the same time the measure of authority to make the improvement at all, is fast becoming obsolete, and the far more reasonable doctrine is now generally accepted that patented or monopolized articles may be specified if an opportunity for competitive bidding is provided whether actually taken advantage of or not.

The duty of municipalities to maintain their streets in a safe passable condition for the benefit of the public, and their right to make local improvements and charge a part or all the costs thereof against abutting property owners at least to the extent that such property is actually benefited, being generally acknowledged the duty of the several counties and States to open and maintain for the use of the public free of charge public highways between the several prominent points in the State, and the right of the federal government "to establish post offices and post roads" for the convenience of the general public being generally conceded, the best method of accomplishing these several results becomes at once a matter of the greatest importance and about which no mistakes should be made.

To what extent these several jurisdictions should act in concert in raising and using public funds to accomplish the desired object is a question about which at this time there is great diversity of

opinion. In regard to cities, it is now generally considered that it is their right and duty to open and maintain streets in their proper condition for the free use of the public and if necessary or advisable charge a part or all the cost of construction and maintenance to the property especially benefited. As to towns and villages through which county or State highways must necessarily pass in reaching large points of general interest, other and more complicated questions necessarily arise as to how such improvements shall be made, how paid for, what material shall be used and how maintained after the original cost of construction is provided.

As to the proposed establishment of "post roads," even more and greater difficulties naturally arise, not only as to the right to use public funds for such a purpose at all, but also as to how these funds are to be raised and how utilized.

In view of the fact that the cities have generally acquiesced in this duty of constructing and maintaining their streets in a reasonably safe condition for the use of the public, and have secured suitable laws and ordinances in most cases for this purpose, in view of the fact that most of the States and counties have already taken steps looking to the establishment of highway laws suitable to the peculiar conditions which each locality must be confronted, is it not the part of wisdom if not of necessity for the federal government under its specific grant of power "to establish post offices and post roads" to formally adopt certain highways as "post roads" and if need be pay the several States or counties through which the "post roads" may pass the fair and reasonable value of present improvements of such roads, thereby enabling the State or county to build additional roads; and as fast as possible not only "establish" but maintain all such "post roads" independently of any State or county regulation or control? If such a system should be adopted, although it might be difficult to start at first, like the rural free delivery mail system, it would soon adapt itself to the necessities of the case, and would become practicable and workable, and we would soon have federal, State, county, village or district road systems applicable not only to the whole country, but adapted to the local conditions of each community through which the several roads may pass.

The raising of separate funds for the original construction and continued maintenance of the different systems of roads, the determination of the kind and character of road to be built, the location and maintenance of the road are all questions which must be left to the several federal, State, county and district or local organizations respectively if satisfactory results are ever to be accomplished. The dividing of authority and responsibility, or the lending of financial aid to be used by local organizations cannot result in satisfactory road construction, which to be successful must have a well organized official head vested with authority to act, and means to be used in accomplishing the desired results.

These are the ends to which all road organizations should contribute. National highways over the most direct route between the principal cities and State capitals to be constructed and maintained by the general government; State highways over the most direct route between the leading towns of the State to be constructed and maintained by State funds managed by State officials and possibly constructed by convict labor; and county or district roads as feeders to these several national and State highways to be constructed and maintained by neighborhood contribution and local officials.

THE CHAIRMAN: The papers are now open for further discussion. Mr. Bregenzer, editor of *The Contractor*, of Chicago, has kindly consented to make a few remarks on the subject.

MR. BREGENZER: The legal considerations brought up by a former speaker, Mr. Bowman, bring up a point very near to the contractor in signing road contracts, and the most important of these is probably the maintenance bond. The maintenance bond militates not only against the contractor in holding up his payments, but in a measure it militates against the manufacturer of good, honest road material. The maintenance bond requires that a certain sum of the amount to be paid the contractor, shall be withheld until the authorities be personally or otherwise satisfied that a road will stand up for a given period. Now in making an analysis, you will find that in the first place the road material is specified by the engineer; the methods of construction are largely specified by the engineer and the materials and methods are supervised by the engineer's inspector. In spite of this, the burden is placed upon the contractor to pay if it does not stand up. I think that is particularly pertinent in reference to the material that is used in the roads.

Another subject of importance that would require a little unification on the part of the contractors in getting some justice would be from the standpoint of bids. A very peculiar thing happened last month in the State of Illinois. About six bids were to be let. They were advertised for, but there were no bidders. On inquiring into the reason we found out that in every case the estimate was so low that the contractor was unable to bid on this work. I think it would be a very good point if contractors would unify on subjects of this kind, so that the standards and costs of doing work would be recognized by the engineers as well as the contractor. Until they are able to accomplish this, the same condition will always prevail, and I think that would be one of the important recommendations to be made in this case. Thank you.

THE CHAIRMAN: Is there any further discussion. If not, we will proceed with the consideration of the next paper, "The Protection and Upkeep of Road Equipment," by Mr. Daniel J. Hauer.

THE PROTECTION AND UPKEEP OF ROAD EQUIPMENT

BY DANIEL J. HAUER

Construction Economist and Consulting Engineer

No matter whether roads are built by contractors or by day labor forces under the direction of engineers, the item of plant and equipment is one of the prominent factors of cost. Inadequate plant means to materially increase the cost of construction. Only recently the writer stood watching some road building upon which only a few tools were being used, and most of them were ill-adapted to the work. It was difficult to accurately calculate the exact amount of money that was wasted, due to a lack of road equipment, but it was easily estimated that the cost of construction was increased at least 25 per cent. Likewise, too much plant can make an added cost. Even with the proper plant, and handled in an efficient manner, the plant item in road construction is a larger per cent of the total cost of the work than in most other classes of construction. This is due to two causes. First, the plant necessary to build a wagon road is much more expensive than that to build, to illustrate we will say, a railroad. With light grading on both, the same equipment will be needed to do the excavation. For the railroad a small concrete mixer may be needed, and some track-laying tools to complete the job. On the other hand, for the wagon road there will be much hauling of road materials, thus wagons and a traction engine will be needed, then road scrapers or graders, and spreading machines, water sprinklers, oil sprinklers, and heating apparatus will be necessary; scarifiers, harrows and rollers must be used, while for concrete culverts and bridges, mixers, derricks, buckets, barrows, and other appliances are called for to do the job in an efficient manner. The writer has constructed a section of a railroad costing about \$100,000, with a plant costing only about \$5000, while a contract for less than \$50,000 of wagon road took an outfit costing nearly \$20,000; 40 per cent of the total cost instead of 5 per cent.

The second reason for the larger cost of plant for wagon road construction is that this class of work is let out in small scattered contracts that are uneconomical from a constructive standpoint. The reason, too, for road building in nearly every section of the country is short.

Naturally the life of any machine is dependent upon the use and care given it. The longer the life, the less the annual depreciation, consequently some of the high plant cost can be eliminated from road construction by the proper care and upkeep of the equipment, and by selecting the most improved and economical types.

As far as possible the same machines should be used for many different purposes. This can be done in two ways: By trying out machines designed for one particular kind of work, for other kinds,

and by adding attachments to machines that thus adapt them to three or four different things.

To illustrate, a contractor once found by experimenting that a certain kind of road grader would spread crushed stone for macadam at a very much less cost than it could be done by any other known method at that time. Then a road roller that can be used as a traction engine, with a scarifier attachment, and likewise for operating a stone crusher, or other machines, can be said to be four tools in one; not that it is possible to use it for more than one purpose at a time but in the present method of building roads a roller is only used a small portion of the time, so it is economical to adapt it to as many uses as possible. In this manner the cost of plant, or rather the investment in plant can be maintained at the minimum.

In like manner, wagons, which are an important factor in road building, should be of the most improved type, and adapted as far as possible to all kinds of hauling. So, too, with concrete mixers. Some contracts demand a hot mixer as well as one for mixing ordinary concrete. Money is saved when one mixer will answer for both purposes.

Another item in the cost of plant is in the character of the plant purchased. Cheap and poorly made plant means money lost to the contractor in several ways. Delays occur through breakdowns and these are always expensive. Cheaply made tools mean continual repairs and a short life, and are an added expense to any job. Only well-made tools should be used. A guarantee as to the construction of a machine can and does mean little. It does not mean payment for delays caused by breakdowns, nor for poor work being done. The ability of a manufacturer for swearing his product is a good one is not a help to a contractor or engineer in getting his work done, nor in showing that the machine in question is well built. The greatest asset is in buying from a firm of recognized responsibility, one of integrity, and one that is so well advertised that they must stand behind their products by putting into them only the best of materials and workmanship. This is the best guarantee possible. This means work done at a low cost. A firm with such a reputation means that thousands of dollars have been spent by them and their customers in obtaining these results. The new customer profits from these past expenditures.

These are all possible factors in plant and equipment, upkeep and maintenance cost. The problem that the contractor and construction engineer must solve in this connection is a very difficult one, owing to the many adverse conditions.

Road work is done in comparatively short stretches, usually in a single season, which varies in length from about one hundred, to one hundred and eighty days, according to the climatic conditions. A contractor's plant is moved onto a job, and is used along the line of the work, part or all of the time during the season. Much of a contractor's plant is made up of transportation machinery, and even

other items of plant are only working in one place for a few days at a time, so that to protect plant while at work on such jobs is very difficult, and in many cases any kind of a protection is a detriment, and a great hindrance to the free movement of the men and teams.

All machinery should be protected when it is not being used, and some when in use. Boilers at work use much more fuel when not protected. Some kind of a house, built in sections should always be used to protect boilers. Such sheds can have one side left out, and a canvas curtain used when necessary. If the sides and tops are built in sections they can be hooked together with hooks and rods and staples so as to be rigid enough to stand up against the wind and weather.

Machinery that cannot be protected while at work, can be covered with canvas coverings over night, during rainy spells and at such times when they are not in use. Every traction engine and roller should be thus protected. Steam drills and such tools can be covered with a canvas jacket. The machinery part of a concrete mixer can be so protected, and also pumps and other equipment. Heavy water-proofed canvas will be found to be excellent for this purpose, and not only keep the machinery clean from dust and mud, but will likewise prolong the life of the equipment. As the canvas becomes worn from use, it must be retreated with water-proofing liquids to preserve it.

At the end of the season, with the job finished, the question always arises, "What shall be done with the plant?" To move it from its present place to some central storage point, will mean an added expense to get it onto a new job. If the work on the same road is to be continued the next season the entire outfit may have to be moved back. The plant can be moved to the next job at the minimum cost from the site upon which it last worked. Then the question comes as to how repairs should be made, and the protection to be given the plant from the winter weather.

Situated away from machine shops, the proper overhauling cannot be given to all the plant, but it will be possible to replace many of the worn and broken parts with new ones, tighten up all loose keys and nuts, true up all bearings, and do all repairing that can be done in the open. Then all iron and wood work can be painted. This is a protection not only against the weather, prolonging the life of the plant, but is also a business proposition that pays well, as everyone is impressed with machinery that looks well, and paint covers a multitude of defects.

In some localities it is possible to obtain an empty warehouse or barn in which the various machines can be stored while they are idle, or during the winter season. This keeps them entirely out of the weather, and also allows of repairs being made under cover, which means not only quicker, but also cheaper work.

For winter storage it is also possible to group a number of machines together, and build over and around them a temporary shelter made

of cheap boards and single ply tar paper, which will last during a winter season. By using the tar paper, the boards can be spread 6 inches or more apart, both on the sides and roof. Around this temporary shed a ditch should be dug so as to prevent surface water from getting to the machines.

If it is not possible to protect the machines by any of these methods, then the canvas coverings can be resorted to, with fairly good results. These covers should, as far as possible, be shaped to the machine upon which they are to be used. Good and substantial brass eyelets should be fastened in the well-bound edges, so that the coverings can be tied tightly to or under the machines, otherwise the wind will flap them loose, soon beating the covering into shreds, as a flag is worn out by the wind, and thus exposing the machine to the weather. Canvas coverings made to fit any machine will always be found useful in protecting machines over night or when not in use for a few days.

Whenever machines are not stored for the winter in buildings, they should be stripped of their brass and glass parts, otherwise these fixtures will be broken or stolen, which means a serious loss. The parts from each machine should be placed in a separate box, nailed up, and properly labeled, the box being stored away for safe keeping. If the machines are stored in a building, it is not necessary to take off parts, as if anyone breaks into the building they must go to the trouble of taking off the brass, while if the parts are stored in boxes, the rascals take box and all, giving them much less trouble, and thus assisting them in making a clean sweep of all the brass fixtures.

When a new machine is purchased, there should always be bought at the same time a number of spare parts, which should be kept on hand to be used as needed. No man can build a machine that will not break down in some vital part sooner or later. A breakdown in a construction job means not only a delay, but a waste of money, for even if men can be laid off and not paid, or can be given other work, yet the job due to the changes made necessary by the breakdown, will not be worked in the most economical manner. It is true that many contractors do keep some spare parts, but they seldom have on hand enough, or the proper ones, due to the fact that as the parts are used to replace broken ones, new ones are not ordered from the factory. Then either one of two things occurs: the job is shut down or some part of it, or the machine is worked with the broken part until a new one can be ordered and put in place. This means that the machine is racked by the work it does, doing permanent injury to it.

A good blacksmith shop on the job, equipped with forge and heating heavy steel and with stocks and dies for bolts and pipe, and with good drills and vises, will be found to be a great assistance in the upkeep of road equipment. For heavy machines a few roller bearing or small hydraulic jacks will be found useful in making repairs and renewals.

Small tools can be repaired promptly in a blacksmith shop. Attention should be given to these as well as to the larger machines. To prevent such tools being lost, they should not only be branded with a die of the contractor's name or initials, but they should likewise be painted with a set of colors, selected by the contractor, to designate his equipment and advertise his business. These colors can be used on the head of some tools, and in most cases on the handles. Tools can thus be seen at some distance, and thus prevent their being stolen or lost. All bright parts of tools and machines that can't be painted should be well greased so as to prevent rusting.

Many of these suggestions seem useless, or more or less self-evident, but anyone who has much to do with road construction knows that tools and machines are scattered along the entire line of a piece of new road construction, just where they were last used, and there they stay, neglected, until they are needed again. Then they are found out of order, and to repair them frequently new parts must be ordered, some days intervening before such parts arrive. The tool or machine depreciates greatly in value by such treatment, and thus contractors are compelled to figure a heavy plant expense item against every job. The cost of caring for this equipment is much less than the depreciation figured against it from neglect.

Such extra costs mean higher prices for road work, and as there are many thousand miles of roads that need improving, every dollar wasted means less mileage built each year. Both engineers and contractors are interested in obtaining good roads, and they should do everything possible to save money in the construction of roads.

THE CHAIRMAN: If there is no further business before this meeting, this session will be adjourned and the finance session will be called to order. Mr. Gash, president of the Illinois State highway commission, will take the chair.

FINANCE SESSION

UNDER AUSPICES OF SPECIAL COMMITTEE OF AMERICAN BANKERS
ASSOCIATION

THE CHAIRMAN: It was not intended that I should preside at any time during the sessions of this Congress, but Mr. William G. Edens, president of the Illinois Highway Improvement Association, is unavoidably absent. His paper on "Financing Road Improvement," will be read.

FINANCING ROAD IMPROVEMENT

BY WILLIAM G. EDENS

*President, Illinois Highway Improvement Association
Chicago, Ill.*

The attention of our people has so recently been turned to the improvement of country roads that the judgment of competent engineers is not yet definite as to the best types of road to be constructed, particularly in the sections where different soils and climatic conditions prevail and where experiments must be made before it can be determined just what types of road it is best to construct.

The matter of financing road improvement, therefore, becomes an important one, for in the middle west particularly and in portions of the country where the population is sparse, the funds available for taxation, especially with respect to bond issues, are not so large as in the older eastern sections of the country and the correct financing of road improvement is a serious and important public question. The people of these sections are perfectly willing to improve the roads but do not care to pay for extravagant experiments which have been tried out in older sections of the country and in Europe and which, owing to changing traffic conditions, have been found to be failures.

I shall not attempt in these brief remarks to cover the bond issue feature of the subject as there are a number of gentlemen on the program at this session who will deal with this phase of the problem. As a result of my travel and experience, however, I feel impelled to say that the western country will insist on a thorough investigation as to the best types of road, their cost of construction and maintenance and a non-partisan, economical expenditure of the money available for road improvement. Our experience in the wasteful expenditure of money under the old Elizabethan system in vogue in many of the States, where a large number of highway commissioners work independently of each other, poorly paid and largely inexperienced and

with inadequate funds, shows that this whole matter, to be successful, must be placed on a business basis.

In Illinois the opposition of the land-owning classes to the campaign for better roads was founded on the belief that the increased taxation for the building of better roads would fall entirely upon the abutting land owners; hence, the Tice bill recently passed by our legislature was drawn on the theory that money derived from automobile licenses supplemented by appropriations from the general treasury raised through general taxation should be used for this purpose. By this means it is estimated that only $27\frac{1}{2}$ per cent falls on the land-owning classes, the remainder coming from corporation taxes and those of the residents of the cities, towns and villages.

Senator Bourne has suggested a novel plan for financing road improvement. Under his system it is proposed to create a fund to be known as the United States highway fund to be raised principally through the issue upon a pro rata allotment basis, at not less than par, of government bonds of denominations of \$20 or multiples thereof; said bonds to be payable fifty years from the date of issue and to bear interest at the rate of 3 per cent, the total issue not to exceed a billion dollars. Each State before being permitted to share in the distribution of this money is obliged to create by law a State highway commission having general supervision of road construction and improvement.

It is a debatable question whether or not the national government should engage in such a system of road financing as that advocated by Senator Bourne and it should be decided only after careful thought and consideration and further investigation. The recent action of Congress in creating a committee on roads in the House would indicate that this matter is to be carefully considered. To this committee will be referred all of the information and recommendations of the select committee of which Senator Bourne is chairman. Certain it is that no funds should be available on the part of the national government for the improvement of roads in the various States until the States themselves comply with the provisions of such national legislation and the law should be of such a character as would prevent individuals from canvassing or campaigning for nomination or re-nomination to public office on the theory that their subsequent election would result in their securing public funds for the construction of roads. We must educate the people who live upon and use the roads as to the benefits to be derived from the construction and maintenance of an up-to-date system of highways and impress upon the road users that the matter of improving the highways is an important part of their duty as good citizens.

The imperative necessity for good roads has become so generally recognized that organized effort is being made to establish a modern system of highways. It is realized that the matter vitally affects our economic welfare and thus merits thoughtful and earnest consideration. In bringing about an accomplishment of this reform we

ought to recognize the fact that the drainage and the care of the earth roads, a large mileage of which will remain in each agricultural state after the principal roads are improved, are to be included in the program. Rural members of the legislature will not continue to vote state aid if the lateral roads, which must naturally remain of the earth variety, are not improved by drainage and dragging and a systematic plan developed whereby these roads are made fairly usable the year round by organizing a force of practical road-builders and care-takers to give them the proper attention.

In our investigation we, in Illinois, found that the money of the taxpayers was being wasted and that of the \$7,000,000 expended annually, 37½ per cent was being spent without any appreciable benefit, and in some counties even more. We have proceeded on the theory that effective work can be accomplished in the matter of road improvement by a system of state and county coöperation in the construction and maintenance of main highways and bridges and so our bill provides for a non-political state highway commission, the members devoting all their time to their duties.

The value of the use of convict labor in the preparation of material for road building and in actual work on the roads is beginning to be recognized more generally than heretofore. In Colorado, which I visited last year, such a plan is followed and the results obtained have been highly satisfactory and are such as would reflect creditably to any State. Warden Tynan of the State penitentiary at Canyon City told me that of the 800 inmates of the prison more than 400 were located in various camps throughout the State engaged in road building, and that statistics showed that 80 per cent of those paroled or released return to useful occupations and make good in their efforts to be restored to citizenship. During the winter months the prisoners are engaged in the preparation of road materials and in the summer months engaged in the actual road construction. This is a system of road construction which any State might profitably adopt. There is great benefit, not only to the State, but to the convict as well, for he is enabled to be employed at outdoor work, which has a tendency to keep him in good health, and after his term of servitude has expired he is the better prepared to resume his place in society.

Since the passage of the Tice bill by the Illinois legislature and which became effective July 1, the warden of the Joliet, Illinois State prison has organized a group of road workers from among the Illinois prisoners and the experiment is now being tried out in our state under the honor system. We believe it will prove to be successful and will be one of the agencies to bring about a reform in prison management so greatly needed as well as an aid in developing a system of improved county roads.

BOND ISSUES FOR ROAD IMPROVEMENT

BY S. E. BRADT

Member Illinois State Highway Department

The importance of road financing has always been recognized, but the underlying principles have been but little discussed. I shall endeavor to present some of the reasons for resorting to the issue of bonds in paying for road improvement, and the conditions precedent thereto.

I am going to assume that, inasmuch as our highways belong to the public, and that the condition of these highways has a very important bearing upon the economic, social, educational and religious advancement of our entire citizenship, it therefore becomes the duty of the people through the public revenue to provide for their improvement and maintenance.

The question arises whether the money for this improvement shall be provided by an immediate tax levy, or by the issuance of bonds, and if bonds are to be issued what would be the conditions requiring this method. Good public policy demands that we should not resort to borrowing money in public affairs:

1. Unless there is urgent need for the improvement.
2. Unless the improvement is of such a magnitude as to prevent its being paid for through the regular course of taxation.
3. Unless the improvement shall be of sufficient permanency as to give full value to those who shall be called upon to repay the indebtedness.

Let us consider these three topics in their order:

1. The urgent need for the improvement. The question that confronts the world today is the same that has confronted it during all the past and will undoubtedly become more acute in the time to come, viz: the food problem. This problem is so large that every fraction taken from the cost of production or the cost of transportation means a saving of millions to the people. While railroad rates have been reduced from $7\frac{1}{2}$ cents per ton mile in 1837 to 7.8 mills per ton mile in 1905, a reduction of nearly 90 per cent; practically no reduction has been effected in the cost of highway transportation. The office of public roads has estimated the total cost of hauling to the shipping point that part of our agricultural, forest, and miscellaneous products, which we market, to be in excess of \$500,000,000 annually. This does not take into account the cost of hauling from the different markets to the farm, or from farm to farm. The office further estimates that by the proper improvement of our highways this cost of hauling can be reduced over 50 per cent, thus effecting a saving of \$250,000,000 annually.

Again, the census figures offer some valuable material showing the need for highway improvement. These figures show that in 1890 36 per cent of the people of this country lived in cities. In 1900

40 per cent and in 1910—46 per cent, an increase of 10 per cent in city population as compared with rural population in twenty years; thus by this movement our food producing population is been depleted to an alarming extent. This question of the movement from the farm to the city cannot be solved until our highways are improved. Likewise the development of country social life, school life, and religious welfare, are waiting on the improvement of our roads. These needs are far greater than the economic, but they are not so tangible and hence do not appeal so readily to the people.

This urgent need for roads is further indicated by the insistent demand of the people for the improvement of our highways. The evidence of this comes from many sources, of which I wish to mention a few. As one of the evidences of the public demand, I want to call your attention to the State of Missouri where 300,000 citizens worked for two days with pick and shovel, with wagon, grader and drag, filling holes, building pikes, rounding up roads, equalling 600,000 days' work donated by the people, who are insisting upon roads that are usable. This is one of the greatest demonstrations of recent years, but it is only the forerunner of what we shall see later on. Within a very short time these 300,000 people will be demanding that instead of the continual repairing of dirt roads the State of Missouri shall inaugurate a system of road improvement along more permanent lines and that their work and their money shall be contributed to work that will endure.

Another evidence of the demand for good roads is found in the rapidly increasing number of good roads associations, international, national, State, county and city. We have numerous national associations, nearly every State has a State association. In some States each county has an association, and no city is too small to boast of a good roads or automobile club. Not only that, but most of the commercial organizations, the woman's clubs, the farmers organizations, the bankers associations, have active good roads committees doing effective work for the cause.

We again see the evidence of this demand in the attitude of the press of the country. No great public improvement during this generation has received such unanimous approval from the press as has this good roads movement. You can scarcely pick up a paper, whether a country weekly or a city daily, that does not contain some favorable mention of the project.

This urgent demand is again very forcibly shown by the fact that during the sessions of the sixty-second Congress forty-seven bills were introduced looking toward the assistance by the national government in highway improvement. This surely indicates that it is only necessary for the friends of good roads in Congress to get together on some broad and equitable national policy in order to give the movement the national aid to which it is entitled.

This resume would not be complete if I failed to mention the greatest factor in this urgent demand for good roads, viz., the motor driven

vehicle. Without doubt we at some time in the future would have had good roads even though the automobile had never been invented, but the coming of the automobile will give us good roads twenty-five, perhaps fifty, years sooner than they would have come by reason of all of the other forces combined. Perhaps the increase in the use of the automobile in the rural districts can best be illustrated by the traffic census taken under the auspices of A. N. Johnson, State engineer of Illinois, at a point on the Central Transcontinental Highway just west of De Kalb, Ill. This census was taken first during six months of 1907, next during August and September, 1912, and again during August and September, 1913. In 1907 the motor driven traffic was 5 per cent of the total traffic. In 1912 (five years later) the motor traffic was 50 per cent of the total. While in 1913 the motor traffic was 60 per cent, thus showing a total increase from 5 per cent in 1907 to 60 per cent in 1913.

Another illustration that came under my own observation was at the annual meeting of the De Kalb County Soil Improvement Association. This meeting was held at a point three miles distant from De Kalb, Ill. The attendance was estimated at 1100. Of this number at least 90 per cent were farmers actually living on farms or operating farms. By actual count there were on the ground 26 horse drawn vehicles, consisting of 18 single buggies and 8 double buggies, as compared with 109 5- and 7-passenger automobiles. Thus it will be seen that not over 75 persons of this company of 1100 farmers came in buggies, while approximately 600 came in automobiles, the remainder coming by trolley. You have heard, even quite recently, that the good roads movement was in the interest of the leisure class of the cities and the pleasure seekers, and that the farmer was opposed to the movement, because only the residents of the city received the benefit. I bring this illustration to show that the time is near at hand when the farmers in proportion to their number will own more motor driven vehicles than the residents of the cities.

I believe, gentlemen, that the foregoing is sufficient evidence of the urgent and immediate need of better roads.

2. Let us now look into the magnitude of the project. In order to determine whether this enterprise is too large to be paid for from the ordinary revenue, we must ascertain the amount required, and what particular taxing bodies should stand the expense. The amount required will depend upon the number of miles we expect to improve, the character of the construction to be used, including width, etc. We have in the United States, according to the office of public roads, approximately 2,200,000 miles of country highways. This office has ascertained by investigation that 15 to 20 per cent of our main highways carries from 80 to 90 per cent of the total traffic; further that 15 to 20 per cent of our highways carries approximately 60 per cent of all farm traffic. This mileage of 20 per cent will be sufficient to cross most of the States both north and south and east and west every six miles, and will include all of the main market roads, inter-county,

interstate and transcontinental highways. Fifteen to twenty per cent of this 2,200,000 miles would be approximately 400,000 miles. It is estimated that 11 per cent of our roads are already improved. This, however, includes all classes of improved roads, such as gravel, the various types of macadams, brick and concrete. It is probable that less than 5 per cent (not exceeding 100,000 miles) are so improved that they will give a wear of over ten years, even the well maintained. We therefore believe that the mileage yet to be improved is not less than 300,000 miles.

Let us divide this 300,000 miles into two classes, viz: the roads connecting all State capitals and larger cities, comprising approximately 50,000 miles; and the main market roads connecting the county seats, cities and villages of the different states, comprising approximately 250,000 miles. The first 50,000 miles above referred to, being the main traveled roads, should be 18 to 20 feet in width. The roads connecting the smaller centers of population, such as county seats, could vary in width from 12 to 16 feet, depending upon the probable traffic.

The cost of improving this system of roads will depend not alone upon the width to be paved, but also upon the material to be used.

I have called attention heretofore to the increase in the motor driven traffic, but this only indicates the change that has already taken place. In all probability the change has but only begun and in the future it will all be in the direction of a large increase, both in the number and in the weight of the motor vehicles. Motor trucks which are much more destructive to roads than automobiles will at no far distant day come into general use, both from the city to the country in carrying freight and from the country to the city in the marketing of farm products. Our main traveled roads, therefore, must be built to standard grade if possible, with a substantial foundation and hard wearing surface, such as brick or concrete.

To accommodate the traffic the 50,000 miles, 18 to 20 feet wide, constructed as above indicated, would cost not less than \$15,000 per mile, or a total of \$750,000,000 for the entire mileage. The 250,000 miles, averaging from 12 to 16 feet would cost approximately \$10,000 per mile, or \$2,500,000,000; thus making the total cost of the entire 300,000 miles \$3,250,000,000.

We are now ready to consider what political divisions or taxing bodies should be responsible for this expenditure.

State road legislation in its beginning, put the entire responsibility of road improvement upon the smallest political divisions, viz: the townships or road districts, this being based on the theory that our road conditions were purely a local matter and concerned only the local communities. After a few decades this manner of handling the road question (because of the broader ideas of the people as to the value of good roads) was found insufficient. In some States the counties were then made the political divisions responsible for road improvement. A little later the county system was found inadequate

and most of the States through State-aid have joined the partnership for road improvement. The enterprise, however, is growing so rapidly that it is becoming apparent that we shall need the assistance of the federal government in carrying on this great work. As I have previously indicated, the people of the United States from one coast to the other and from the north to the south are awakening to the fact that road improvement is essential and urgent; that the task is so great that all the forces must combine for its solution.

The government has about completed one of the most stupendous undertakings of modern times, the Panama Canal, at a cost of from \$300,000,000 to \$350,000,000. The time is now ripe for the federal government to undertake a greater work, one that will be of more direct benefit to our people from the standpoint of a higher citizenship, a contented farm life, as well as from the standpoint of the effect upon the food supply of the nation, than a score of Panama Canals. Each year the government is appropriating very liberally for public buildings, for improving rivers and harbors. Much of this work is necessary, but none of it would benefit the people so much as the same amount of money applied upon the proper development of a well planned and equitable system of highways.

As has already been suggested by others, if all the associations of the United States, national, State and county, that are now working for road improvement could unite in asking Congress to authorize the appointment of a commission whose duty it shall be to conduct a thorough investigation and report back to Congress a plan recommending the extent to which the government shall enter into this work; to report also whether the government shall construct and maintain a system of national highways or give to each State its proportion of assistance in improving State roads; and further to provide a plan by which the roads to be improved shall be designated. If, I say, this plan could be put into effect then this great project would soon be under way.

If we grant the premises in the foregoing discussion to be true, then the conclusion is also true that we are warranted in asking that the government shall over a period of fifteen or twenty years assist in this road movement, at least to the extent of the cost of the 50,000 miles of interstate highways which we have estimated at \$750,000,000. Congress has authorized the issuing of bonds for the building of the Panama Canal, a project of approximately half the cost of this system of highways; and should the revenues of the government require it, bonds should likewise be issued for the construction of our highways. If the government undertakes to furnish this \$750,000,000, as above, there would still remain the sum of \$2,500,000,000, to be contributed and expended by the States and counties, in proportion to the total mileage of each State. This amount of money spread over a period of fifteen years would mean an annual cost of \$166,000,000 to the States and counties of the nation. This is indeed a large annual expenditure, but let us analyze the situation.

Let me again call your attention to estimated annual traffic loss of \$250,000,000. When we shall have improved the roads that carry 80 to 90 per cent of this traffic, then we shall be saving from 200 to 225 millions annually, hence from this standpoint, the improvement will soon pay for itself. Again, we are now expending annually on our roads and bridges in the United States a sum estimated at \$180,000,000, \$150,000,000 of which is being raised by general taxation and \$30,000,000 by bond issues. This, as you will notice, is largely in excess of the annual expenditure called for in this proposed system of roads. Of this sum \$180,000,000, \$100,000,000 is now being expended in building and repairing bridges and culverts and caring for the earth roads and \$80,000,000 in the more permanent types of road construction. These earth roads are bound to constitute by far the larger part of our roads to come, and we must continue not only to care for them as we have done in the past, but to increase their efficiency by more thorough and scientific methods of maintenance.

It is generally conceded that at least 25 or 30 per cent of money now expended on our earth roads is being used in a haphazard way that brings no permanent benefit which would mean that \$75,000,000 economically administered would give us a much better system of earth roads than we have today and leave \$25,000,000 for other purposes. If this \$25,000,000 could be added to the \$80,000,000 now being expended on hard roads, we would have a sum of \$105,000,000 for that purpose and thus leave only about \$60,000,000 still to be provided for. Without question the taxes for the maintenance of State governments, municipalities, schools and roads are already a sufficient immediate burden upon the people. I therefore feel justified in taking the position that this project is too large to be paid for through the regular channels of the State and county taxes; and that at least the \$60,000,000, above referred to, in addition to the \$30,000,000 now being raised by a bond issue should be provided for by the same method, viz: the issuance of bonds.

Our third requirement is that the improvements shall be of sufficient permanency to give full value to those who will be called upon to repay the indebtedness; in other words, that the maturity of the bonds shall come within the life of the improvement, or in the language of roads that we should not issue fifty year bonds to build fifteen year roads. This principle has often been disregarded by States and municipalities, not from a desire to impose a burden upon those who have to pay the cost, but from a lack of correct information as to the durability of the work for which the bonds were issued. I believe that this has been to a considerable extent excusable in the matter of road construction, because of changing traffic conditions that could not be foreseen. Those in charge of this construction have lived up to the best information obtainable and built along lines approved by the best road engineers. The failure of this class of roads to withstand the changing traffic is not sufficient reason, however, why bond issues should not be utilized within proper limits in the future.

We are today in position to judge sufficiently of the traffic requirements for the next twenty years to be able to build our roads to meet those requirements. This being true, it then follows that inasmuch as the coming generation is to share in the benefits of the roads, equity demands that it should also share in the cost which can only be done through the issuance of bonds.

We do not hesitate to issue bonds for other public improvements, such as water works, sewer systems, lighting plants and school buildings. None of these improvements are permanent. All require maintenance, many require frequent renewals to maintain efficiency, but if the foregoing principle is observed no injustice results. If we shall attempt to build this system of roads, spreading the work over a period of fifteen years, building one-fifteenth each year, paying one-half the cost of this portion by direct tax, and issuing fifteen-year bonds for the remaining one-half, we would distribute the cost over a period of thirty years; but each section of road so built would be paid for within fifteen years from the time of its construction. The burden upon the taxpayers would be but little more than at the present time; further it is evident that through a proper organization of the work by our states and counties with a definite purpose, the money would be conserved; haphazard work would be eliminated, and the people would receive real value for the money expended.

Let me summarize briefly: I have called attention to a few of the evidences of the urgent need, as well as the insistent demand for road improvement. I have given you an idea of the vast sum of money that will be required and have tried to show the necessity of enlisting all of the available forces in this work, from the road district to the federal government. Further, we have seen that the work should not be delayed indefinitely but that, in order to have this generation receive a share of the benefits, we must resort to bond issues by each of the taxing units entering into this work; also, it is clear that equity demands that through the payment of bonds a share of this burden be placed upon the future taxpayers, who will enjoy their proportion of the benefits.

The people are in earnest in their demand for good roads and when they unite in demanding anything they always get it. Whether the methods by which they get it are sane and conservative and give the people real value for their money, depends upon the leadership. No man can lead, unless he has the vision. No man should be permitted to lead, unless the vision is counterbalanced by conservatism. No man should be permitted to lead, except along the lines of the newer ideals in public affairs, which are nothing more than common honesty and unselfishness.

MR. MYERS (of Ohio): We have discussed road construction and maintenance and we have certainly profited very much. It is a national affair. We are correspondingly responsible, with justice to all. We come down to upkeep and protection, which has been

discussed and which has been very vital, and we are now down to bonds and maintenance. It occurs to me that it is only fair that the farmer, who is assessed by the township and by the county, should be protected in a way, and while they are expected to use the roads and they are willing in the main to be assessed, they are not willing that those roads that cost from \$2000 to \$25,000 a mile, according to the different methods employed, should be maintained at an expense in the issuing of additional bonds, incurring additional hardship because of that maintenance being severe, owing to the fact that because of the use of motor tractors now used on those roads between our city and Cleveland, Mansfield and Akron, carrying six to eight tons—half as much as we can put into an express car, without being assessed for commercial use. This does not appear right to me as compared with the farmers use and what he is paying for it, and I think this being a national affair, it is only proper that we should consider some revenue (instead of issuing additional bonds) accruing from those who use the roads in a commercial way. Those of us who are engaged in railroad and traction lines have first got to pay for the right of way, we pay \$20,000 to \$25,000 for equipment, we are assessed very heavily as you know, by each township and county through which we pass, and then we have to pay tribute to the interstate commerce and public utility and all that, and here comes along the department stores or the men who manufacture raw material and distribute their wares over the highways that are made by assessment on the common public, and it occurs to me that it is a very important matter that we should take up and see that those who use the roads in a commercial way, for commercial gain from one city to another, such as I have named, which occurs here no doubt in Detroit and intermediate points, should be made to pay by paying a certain duty on benzine or something which would protect them or protect the wayfaring public as against the inequality that is existing and will exist.

A. E. BEABY: I believe in good roads. I am a farmer over in the western part of Michigan. I own automobiles; I am willing to help pay my share, a goodly share, to build good roads, but every dollar I pay for good roads, I want to be an efficient dollar. I don't want to pay dollars to pay interest on bonds. I don't want to be bonded or have my children after me bonded for good roads. This good roads question is an everlasting proposition. Two million miles of roads in America—this emergency is continuing, this emergency is going to be here for a hundred years and there is no more good reason for issuing bonds for good roads than there is for issuing bonds for the running expenses of the State of Michigan. In some way and somehow, we farmers have been getting our products to the market. Now, you may not understand me, the language of a farmer is different from the language of a banker; it puts me in

mind of an old sailor that came into our county years ago. Instead of talking to his team as the near ox and the off ox, when they turned the yoke he says, "You blamed starboard ox, you get over on the larboard side." We have and have had too many politicians in this country who were starboard fellows at home but when they got to Washington they got on the larboard side. We don't want \$750,000,000 of bonds issued to be carried on the backs of these people; it will create a higher cost of living than anything you can do. I am willing to stand any burden of direct tax that they see fit or that the public is willing to put on to me, to make it a direct application for the building of roads, but I do not want to see sixteen-year bonds issued nor twenty-year bonds issued and at the end of that time we have paid for 2 miles of road and only got 1 mile of road built. Now, I am interested in banks; I have often been interested in banks and have always tried to get my interest out and am getting it pretty near all out of them and I am willing to stand a good heavy tax for good roads. I believe that money expended that way, in a public way, adds more to human happiness and the comfort of animals than money expended in any other way, but give us a direct tax and let us pay as we go. I thank you, gentlemen, for your kind attention.

MR. BRADT: They have authorized bonds for the Panama Canal but have only issued \$140,000,000 out of an authorized issue of \$350,000,000. The government revenue will take care of it, and this \$50,000,000 over fifteen years or \$37,500,000 over twenty years will undoubtedly be taken care of through regular channels of taxation by the government, just like the Panama Canal, and I suggested roads instead of some other improvement the government is making, but not a bond issue; I said that bonds should not be issued unless the life of the improvement is within the life of the bond, so that the man who pays those bonds gets full value received for his money. Now, in its relation to the farmer, this matter of the motor traffic, I think that will be taken care of by our State legislature through a motor vehicle tax which will be graduated according to the size of the motor, but I think this, that our farmers will be using these large motors before many years themselves. I think I have shown that the automobile end of it will draw no line in the future between the farmers and the residents of the town, because the farmer is going to own more automobiles than the townpeople, and when it comes to auto trucks, I think it will be the same in a few years.

MR. SMITH (of New Jersey): Mr. Bradt brought the paper up to a certain point, but in this matter of issuing bonds did not go far enough. We had a case in New Jersey where we had laid out a 7-mile road across country to the railroad station. Before that road was built, they had been carting one ton to the load; since the road was built, they have been carting three tons to the load. An

old farmer had objected to it, and he was the only one along the route that did object but he soon "tumbled" and was doing his carting with the rest. We then talked of another good road and proposed to issue bonds for \$20,000 and have this road for use also. Immediately after the first road was built, the land along it had risen from \$80 an acre to \$100 an acre, and just as soon as the State road was finished, the farms along there brought \$100 to \$120 an acre. Then another old farmer objected and brought up the argument "Don't you think it would be a very mean trick for me to vote for them bonds and leave that debt to my children for an inheritance?" I said, "Your farm has risen 20 per cent; you are saving \$450 a year in cartage; don't you think it would be better to build the road and issue the bonds and leave to your children a farm worth 20 per cent more money?" He said, "Golly that's so, I didn't see it that way, and I will vote for it sure pop?"

MR. BEABY: But if that farmer had paid it all and left no bonds for his children to pay, he would be doing a better act yet.

MR. SMITH: But unless we had issued the bonds, we could not have had the road.

MR. BRADT: Those children are to get the benefit of the road and ought to pay for it.

MR. BEABY: I don't believe in bonding the unborn in this country; I don't believe there is any patriotism in that at all.

MR. BRADT: They are going to get some benefit of what we do here and it is no harm for them to pay a little.

THE CHAIRMAN: The next paper is "Highway Accounting with Special Reference to Maintenance," by Halbert P. Gillette, Chief Editor *Engineering and Contracting*.

HIGHWAY ACCOUNTING, WITH SPECIAL REFERENCE TO MAINTENANCE

BY HALBERT P. GILLETTE, M.A.M.SOC.C.E.

Chief Editor of "*Engineering and Contracting*"

The time is at hand when accounting and cost keeping methods that have proved so effective in the management of private enterprises will also be universally applied to public works. There is fundamentally no economic difference between a road and a railway. Hence accounting methods that have been developed in the construction and operation of railways should prove efficacious in road construction and maintenance.

Every well managed railway has an itemized plant or property account. How many ledgers relating to a system of highways will show the itemized investment in the entire mileage? Every well managed railway has an itemized maintenance account that shows the monthly and annual maintenance expenses by divisions. Of how many road systems can the same be said? Every well managed railway is careful to distinguish between expenditures that add to the investment in plant and expenditures that merely renew superseded and worn out parts of the plant. How many road ledgers show equal care in this vital matter? And it is vital, economically, not to confuse renewals with betterments; yet we all know of many recently published statements of road maintenance costs wherein more than half the cost was not maintenance at all.

When an old waterbound macadam is scarified and enough new metal added to bring it to its *original* thickness, the cost thereof is a maintenance expense. But if metal is added in amount sufficient to make the macadam 8 inches thick where it was 6 inches thick at the time of original construction, then the added 2 inches is not a maintenance expense, but is an addition or betterment which should be charged to the property account. Even to a more marked degree is this true when a waterbound macadam is given a bituminous surfacing.

The editor of at least one prominent engineering periodical has recently written the almost prohibitive cost of road maintenance, and has cautioned the public against bonding for road construction because of the short life of modern roads. This serious editorial error is the result of inadequate knowledge of proper accounting methods, for published road maintenance data are apt to deceive those who think that "maintenance" means what it should mean. As a matter of fact "maintenance," as commonly used today in reference to roads, means true maintenance and betterments combined, and is therefore a deceptive term.

Maintenance expense should never include anything else than repairs and renewals. Any expenditure that adds to the inventory cost of a road is an addition or betterment and should be charged to the property account. By this criterion it follows that if a worn 6-inch macadam is scarified and increased in thickness to 8 inches, the first cost of a 6-inch macadam is deducted from the first cost of an 8-inch macadam and this difference is charged to the property account. The balance of the expense involved in scarifying, metalling, rolling, etc., should be charged to the maintenance account under the head of renewals.

The writer prefers to keep distinct the two kinds of maintenance—repairs and renewals. Under repairs are charged patching, patrolling and other small or continuous maintenance expenses. Under renewals are charged general resurfacing and all renewals of large parts or units. Thus, in the case of a bridge the cost of painting is a repair expense; but the replacement of an old bridge by a new one is a renewal.

Since it is rare that a highway official will find a properly kept set of construction and expense ledgers left by his predecessor, the question arises whether it is worth while to inventory or appraise the existing roads. Most emphatically it is worth while. One of the best ways of rating the annual maintenance cost of any structure or machine is as a percentage of its first cost. Obviously this cannot be done where the first cost is not even vaguely known. Estimates of future maintenance expenses are often best determined by taking percentages of the first cost of each item. These reasons alone warrant making an appraisal of any plant, but, in addition, the owners of a plant are entitled to know how much capital is invested in it. Who can tell with any degree of accuracy how much capital is now invested in the roads of any large State in America?

The writer has made a rough estimate of the investment in roads in each state, and it serves at any rate to disclose sad disparity in capital invested in roads compared with railways. Accurate figures of this sort for each state should serve to awaken the public to realization of its past niggardliness in road improvement. Now that the Interstate Commerce Commission has begun the appraisal of all the railways, it will soon be possible to contrast the investment in railways with the investment in roads, provided we begin soon to appraise our highways.

In opening a property account for a system of roads, it will be well to study the printed instructions to railway accountants issued by the Interstate Commerce Commission; also the printed instructions issued by various state public service commissions.

The writer would suggest a property account for roads as follows:

ROAD PROPERTY ACCOUNT

1. Engineering, superintendence and inspection.
2. Administration and legal.
3. Real estate and right of way.
4. Clearing and grubbing.
5. Grading.
6. Retaining and slope walls.
7. Bridges, culverts and drains.
8. Fences and Signs.
9. Trees, sod and foliage.
10. Paving.
11. Buildings and fixtures.
12. Furniture and instruments.
13. Stores and supplies.
14. Tools and machinery.
15. Miscellaneous.
16. Bond discount.
17. Interest during construction.

All existing roads should be appraised at the cost of reproduction *new*. The depreciated condition may be ascertained, but it

is the cost new that should always appear in a plant account. It is now considered bad accounting to "write off" any part of plant value because of depreciation. Preferably a separate account called depreciation reserve is provided.

Having opened the construction ledger of a system of highways, using the appraised cost of reproduction new to start with, the cost of every new road and every betterment should be entered in that account, item by item. Many of the seventeen items above given should be classified into sub-items. Of course each new road improvement should have its own separate itemized account, and it would be well to adopt the method used by railways in designating each improvement by a numbered A. F. E. An A. F. E. is an "Authorization for Expenditure." It is made by filling in a printed blank with an itemized estimate of quantities and cost of the proposed improvement and the reasons why the improvement should be made. It is given a serial number, and signed by various officials. Care should be taken to keep the record of actual cost in such a way that it can be entered in detail on the original A. F. E. in a column parallel to the column of estimated cost. If the totals of the two do not check within 10 per cent, reasons should be given for the difference. Instead of extending a given A. F. E. to cover more work than was originally contemplated, the writer prefers to issue a separate A. F. E. for the extension.

Corresponding to the A. F. E. for large additions and improvements is the W. O., or "Work Order," for minor betterments and maintenance. Work orders should be numbered serially, and, where possible, should contain detailed estimates of cost as well as the actual cost in equal detail. In addition, a work order should show in detail how the actual cost is prorated between Maintenance and Improvements.

The location of the work should be described on each A. F. E. and W. O., but, in addition, there should be a map record of every A. F. E. Care should be taken to enter on the map the numbers of the A. F. E. and on the A. F. E. should be recorded the map number. If this is not done, it often becomes difficult in subsequent years to correlate the maps and A. F. E's.

In addition to a system of accounts that find final summary in two sets of ledgers, namely construction ledgers and maintenance ledgers, there should be a separate system of unit cost-keeping records. Ledger accounts must be precise. Cost-keeping records, however, need only be approximate; for the main object of cost-keeping is to ascertain unit costs with sufficient accuracy to determine whether work is being economically done. Of course unit costs also serve for estimating the cost of projected work, but this is a matter of small importance contrasted with the use of unit costs as a criterion of efficiency. Accounting is a function of book-keepers and accountants, but cost-keeping is a function of engineers. By this I do not mean to imply that engineers should not understand

accounting, nor do I mean that there should be entire divorce of accounting from unit cost-keeping. To attempt to record in ledgers the data needed in calculating all unit costs results in greatly complicating the accounting system. Moreover, a good accounting system lacks the flexibility so essential in a good system for recording unit costs. As a rule, the engineer in charge of work finds it desirable to change the method of recording unit costs to fit the local conditions, the character and magnitude of the work, and the sort of men available for keeping the records. An accounting system, on the other hand, should remain the same for all jobs and from year to year.

Of course unit cost records should show labor and material costs separately. It is desirable that the same separation should also be followed in the accounting system. When this is done it is possible to check roughly the total payroll charged in the ledgers against the total labor cost recorded by the engineers on their cost blanks. Similarly with the total cost of materials. Errors are thus frequently disclosed, and occasionally the "padding" of payrolls and other dishonest acts are brought to light.

Too much stress can not be laid on the economic necessity of detailed unit cost-keeping. Even for the smallest of jobs, unit costs should be ascertained, if for no other reason than to show that unit costs on small jobs are often several fold as great as on large jobs of the same character. Much money is annually wasted in puttering. Once the total waste is expressed in dollars it usually is seen that most of the puttering can be done away with entirely. This is particularly true of road maintenance. The writer is of those who believe that too much road maintenance consists of patching in small units. There is not a little economic falsehood in applying too literally the "stitch in time" policy. Unit costs, and nothing but unit costs, will show to what extent it is economic to use a parole system of repairing.

To unit costs we must also look for the answer to the question whether day labor or contract labor is more economic. Practically all the recorded unit costs relating to road construction indicate that contract work is cheaper than day labor work. The a priori reasons for this are numerous; but since there are not a few men who believe they can "save the contractor's profit" simple justice demands that they prove it by recording and publishing the unit costs that occur when they attempt to do so.

In conclusion the writer would repeat the suggestion that the accounting methods of railways and other public utilities be thoroughly studied by those who are in charge of highway construction and maintenance.

It is not sufficient merely to know the principles of double entry book-keeping as it is commonly applied in business enterprises. Public utility accounting is a special science that involves many departures from the ancient art of book-keeping from which it has evolved.

THE CHAIRMAN: This session is going to come to a close. The next is the Economics Session. Upon this question I believe in the principles of equality and the right of the people to rule. That was established in the beginning of this government, as you all remember, when our forefathers, under the leadership of Jefferson, said, "We hold these truths to be self-evident, that all men are created equal, that they are endowed by their creator with certain inalienable rights; that among these are life, liberty and the pursuit of happiness. That, to secure these rights, governments were instituted among men, deriving their just powers from the consent of the governed;" and upon this question of roads, we will have the kind of roads that the people of this government want in every part of this Union, in every township and county of it. Now, we are going to have what the people want. I take pleasure in introducing to you Dr. Joseph Hyde Pratt, who will now preside over the economics session.

ECONOMICS SESSION

UNDER AUSPICES OF AMERICAN HIGHWAY ASSOCIATION

DR. JOS. HYDE PRATT in the chair.

THE CHAIRMAN: I will ask the session of economics to come to order. We will take up at this session perhaps the most important phase of the road problem—the administration of road funds. No matter how much money you have raised with which to construct roads, or how you have raised it, if it is not expended in building *good* roads, and expended economically, you have lost out on the road problem. It is absolutely essential, in carrying out the expenditure of any money, whether raised by direct tax or bond issue, that that money be expended under the supervision of a man who knows how, i.e., the road engineer. He should be given such authority over the unit of his jurisdiction, whether it be a township, county or State as will enable him to expend the road money to the best advantage with regard to location, construction and maintenance of the public roads of the community for which he is working. Your road commission may decide what roads are to be built first, what places are to be connected; but the location, the method of construction and the maintenance should be left to the engineer who has been employed to take charge of the road work of the State or county; and, if he is not capable of doing that, he should get out and you should employ an efficient man. If we carry out that plan and do put in charge of our road work the man who knows how, we will be able to get out of every dollar appropriated a dollar's worth of good roads.

Now, in order that our engineer shall be able to carry out and do his work to the best advantage, he has got to have under him in the State or in the county as the case may be an organization that he knows will carry out his instructions in regard to the road work. I believe in deciding upon what character of road to build; whether concrete or vitrified brick; tar or asphalt macadam; sand-clay or gravel, should be determined by the amount of traffic that is to go over that particular road, which of course will determine the amount of money needed to construct that particular road. I do not believe that any community should incur debt to build the finest kind of concrete or asphalt or vitrified brick road when the traffic over that particular road does not demand such surfacing material and a sand-clay or gravel road surface would serve the traffic that goes over it just as well.

There is one thing in connection with road work that we should always keep in mind, and that is that no road, however well it may

be constructed, or the surfacing material may be, is a permanent road, i.e., it is going to constantly need repairs and in your organization, in your plans for your public road work, you should always arrange to have a sufficient fund at all times ready with which to maintain the road you have built. It is part of the work of the engineer in making his organization to work out a plan for the maintenance of the road as well as for its construction.

There is one part of a public road that we might call permanent, or at least it should be permanent, and that is the location. This is especially so as to sections of this country that are being built up. When the road is once located, if it is located by a competent engineer—a man who knows how—you have it in a permanent place and there should be no question about re-locating that particular road. Then, when you come to surface that road, if the traffic at a particular time simply demands a sand-clay or gravel surface put it on; and, later, in fifteen, twenty or thirty years, say, if the traffic becomes so great as to require some other surfacing material, such as tar or asphalt macadam or concrete or vitrified brick, you have a foundation for the new surface in that you have a good location and grade; and you will have, on account of increased traffic, accumulated wealth sufficient to give the money or the revenue with which to put on the different surfaces required by the increased traffic. The location, therefore, is the only part of the road that we can call permanent, and we should see to it that in all road work location be made as permanent as it is possible to do it with scientific skill and intelligence. I believe you will agree with me that the subject now under discussion in this session of Economics of Road Work is as important as any that we have taken up.

We have not a long program today, and I would like to ask Mr. Shirley, of Maryland, if he is in the audience, to come on the platform, and Mr. Wilson, if he is here, and also Mr. Atkinson, if he is here, to come on the platform. I have a copy of Mr. Shirley's paper, the title of which is "Systematizing the Purchase of Road Materials and Equipment." This paper has been printed, and as Mr. Shirley, apparently, is not here, the paper will not be read except by title, but it will be open for discussion by any of you who want to take part in discussing this subject. In order to start that discussion, there is just one word I would like to say in regard to this paper, and that is that I am heartily in accord with practically all that Mr. Shirley has stated in his paper in regard to systematizing the purchase of road materials and equipment. I want to carry that thought into what I said before regarding the engineer. I believe that the road engineer, who is in charge of road work in the State or county, should also have direct supervision of the purchase of all equipment and materials to be used in connection with the road work under his supervision. I don't care what character of men compose your county or road commission, who have charge of the road work and to whom the engineer is responsible, there is

no man on any such commission who knows what you need for your road work as well as your engineer who is in direct touch with every single phase of the road work. I am going to illustrate by one thing that happened in my own State, in a county where the county was a unit in road work and had their own engineer. The commissioners, who had charge of the road work and employed the engineer, did give him the authority over all the road work except at the start in regard to the purchase of supplies, materials and equipment. He insisted that the cost of all materials and supplies used upon the road work were items of cost that had to be estimated in average cost per mile of his work and he must know what was being ordered and what was being paid for the materials ordered. He insisted that he must have that authority or else he would not hold the position. They gave it to him and the first bill that he went over he saved that county his first year's salary. Now you can imagine what they were going to pay for the materials ordered. I may say that county had a bond issue of \$400,000 to spend on its roads and were buying equipment commensurate with that bond issue.

SYSTEMATIZING THE PURCHASE OF ROAD MATERIALS AND EQUIPMENT

BY HENRY G. SHIRLEY

Chief Engineer, State Roads Commission of Maryland

The great increase in road construction, and the large amount being expended by many States and cities for material and equipment, makes the systematizing of all purchasing a necessity. All materials and equipment should be purchased by asking for bids and awarding the contract to the lowest responsible bidder. A purchasing agent should have full charge of the purchasing department, and should make all purchases. The system used by the State roads commission of Maryland, and inaugurated in July, 1912, under the present purchasing agent, is as follows:

1. A requisition is made out in duplicate (see form on p. 221) by a resident engineer, superintendent, or a head of a department. The duplicate is retained by the maker for his files, and the original is sent to the chief engineer, who examines and approves the requisition, or strikes out such items as he thinks unnecessary. The requisition is then submitted to the chairman of the commission for his approval, and then to the purchasing agent for his signature.

2. After the purchasing agent has signed the requisition, he immediately gets in touch with the material or machinery people, (as the case may be), and requests that bids be submitted by a certain specified time.

The requisition shows whether the material or equipment is to be used by the construction or maintenance departments; the contract number of the work on which such material or equipment is to be used; the person or persons, name or names to whom the article or articles are to be shipped, as well as the railroad station, section of road on which same will be used, and the name of the county in which the road is located. The requisition also shows the quantity or number of items desired, and a brief description of each. Satisfactory bids having been received, opened and tabulated, the contract is awarded to the lowest responsible bidder, and the order for material or equipment is made out on the order blank (see p. 222).

On the order sheet is specified each item, the requisition number, and to whom the material or equipment is to be shipped. The following printed instructions on the back of the order sheet, instruct the consignee how to ship:

1. Send all invoices to 601 Garrett Building, Baltimore, Md. Do not unduly delay shipment of order to complete same, but if necessary, forward in installments. Mail invoices with bill of lading promptly after each consignment. Order and requisition number must be marked plainly on each package and invoice. The number of packages should be marked on invoice.

2. INVOICE blanks will be mailed on application.

3. Do not send more goods than are ordered, as they will not be paid for, but will be returned at the expense of the consignor.

4. Accounts will be closed on the 25th of each month and paid on the first of the following month, and bills received after the 25th will go into next month's account, regardless of the date they may bear. No drafts are authorized or paid.

5. This commission will not be responsible for any goods shipped, unless covered by an official order from the purchasing agent.

6. Render monthly statements direct to purchasing agent.

7. Orders must not be filled at an advance in price over last quotation without first notifying this office and obtaining our consent.

8. All material ordered is subject to test and inspection. If rejected, it will be returned at the shipper's expense and must be replaced with material which will strictly comply with our specifications.

9. The option is reserved on my part of cancelling this order if not filled within 10 days from date, unless otherwise specified.

10. Render separate bills for each order.

Along with the order, the following three bill forms are sent (see p. 223).

The original bill gives the order number, the requisition number, the date of shipment, the name of the party to whom the shipment was made, the car number and initials, the name of the firm from whom the articles were purchased, and the date on which the purchase was made.

It is required that the name and kind of equipment purchased, be clearly and intelligently stated in the body of the bill, and no money

STATE ROADS COMMISSION

PURCHASING DEPARTMENT

E. H. ZOUCK,
PURCHASING AGENT.

<p>THIS NUMBER MUST BE PLACED ON EACH PACKAGE</p> <p>Req. No.</p>	<p>ORDER</p>
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Baltimore, Md.,191.....

Please send to THIS COMMISSION THE FOLLOWING Material and forward bill of same in accordance with instructions on back of this order, which must be strictly complied with.

See Notice on Back; which please read carefully.

Above Material is purchased f. o. b.
Freight must be prepaid on all orders shipped.
Ship to

 Mark State Roads Commission

Care of

If you cannot fill this order by date
named, please advise me at once.

F. H. ZOUCK,
Purchasing Agent.

Per

(ORIGINAL)

DEPT. No.

STATE ROADS COMMISSION

Order No. Req. No.

Date Shipped.

Shipped to.

.....

Car No. Initial.

BOUGHT OF191

Address

(Street and Number)

NOTICE—All Bills against this Commission for supplies ordered by the Purchasing Agent must be made out upon these forms, AND SENT TO PURCHASING AGENT'S OFFICE, Baltimore, Md., with Bill of Lading.

 STATE NAME AND KIND OF MATERIAL CLEARLY AND INTELLIGIBLY. 

Checked:

Purchasing Dept. by

I hereby certify that the above goods were purchased upon approved requisitions and that the account is correct.

.....
Purchasing Agent.

Dept. Receiving, by

I certify that the above supplies were received.....

.....19, quantities, quality and weights correct.

Aud. Disbursements, by

CORRECT, CHARGE TO

will be paid out for material or equipment purchased, unless the bill is made out in triplicate by the consignor, on the forms furnished by the purchasing agent. When these forms have been properly filled out, the original is forwarded to the purchasing agent, together with the bill of lading. The duplicate and triplicate bills are sent by the consignor to the person for whom the material or equipment has been purchased, who signs the duplicate copy, thus showing that the articles named on the bill, were received, and the date on which they were received. He then, at once, forwards the duplicate bill to the head of the department, keeping the triplicate bill for his own files. Likewise, the purchasing agent forwards the original bill to the head of the department, who certifies that the supplies were received on a certain date, and that the quantities, quality, and weights are as ordered. The original bill is then returned to the purchasing agent, who certifies that the articles shown on the bill were purchased under an approved requisition, and that the account is correct. The bill is then sent to the auditing department for disbursement, after the name of the county, the contract number, and the item number to which it is to be charged, has been placed on it.

The system is very simple, as the requisitions, orders, and bills are all printed with the proper headings and directions, and it is only necessary, therefore, to fill out the blanks with the proper dates, numbers, items, etc., thus giving the minimum amount of labor for making up the order and bills.

Too much stress cannot be placed on the great importance of systematically purchasing materials, and equipment, and this can only be done by having an experienced purchasing agent, who will keep in close touch with the market, and who knows from whom the most advantageous purchases can be made.

A purchasing agent should be a man who has had experience in purchasing equipment and material, and of unquestionable honesty and integrity. Aside from the large amount saved by the systematic purchasing of materials and equipment by an experienced purchasing agent, the cash discounts for cash payments made within ten days, allowed on many bills, will pay the expenses and salary of the purchasing agent and his department.

THE CHAIRMAN: The paper of Mr. Shirley is now open for discussion. If there is no discussion of Mr. Shirley's paper, I will call upon the next speaker who will discuss the subject of "The Labor Problem in Road Construction." I take pleasure in introducing to you Captain P. St. J. Wilson, State highway commissioner of the State of Virginia.

THE LABOR PROBLEM IN ROAD CONSTRUCTION

BY P. ST. J. WILSON

State Highway Commissioner of Virginia

Most of the problems in connection with labor in road work are identical with those in other similar work, and are familiar to all who are accustomed to handling labor. I therefore feel that I can be of little service in laying before you my troubles in this connection, having only a partial suggestion as to the remedy.

Road work, in order to get the best results, requires a certain amount of skilled labor, and also a certain amount of skill in all the labor used. The men who cut the ditches, shape the road bed and do almost any other work, can materially aid the progress by doing skillfully the work to which they are assigned. The real labor problem, as I have found it, is to secure regularly the amount of skilled and common labor necessary to carry on the work economically. My case is probably an extreme one. In Virginia most of our work has been remote from the cities, in sparsely settled communities, where they are few laborers without more or less regular employment; yet the work is so scattered that many of the pieces are too small to justify importing laborers from any considerable distance and making provision for their maintenance. We have therefore been compelled to rely largely on local labor, and are often seriously handicapped. Not infrequently has it happened that we have been compelled to shut down work for a month or more during the best road building season, while the labor went to harvest the crops in the neighborhood. When you are told that our joint State and county fund in a few counties is as small as \$1200 per year (ranging from this up to about \$20,000), it may readily be seen how little work can be done in some places. In a number of instances, where the amount of work was sufficient to justify the importation of labor, parties in the neighborhood, even farmers interested in the road, have taken the labor away by offering higher wages than we were justified in meeting, considering the price of labor locally and generally throughout the State. With us there are few contractors equipped for road work, and although we always advertise for bids on our work, we often have no bids at all, and still more frequently, the bids are so high that we are forced to reject them, and the consequence is that much work is done directly by the commission. During last August one hundred and thirty pieces of work were under way at the same time, scattered over sixty counties, and only twenty-eight of this number were under contract. To supply the necessary number of competent foremen and operatives, as well as laborers for these various pieces of work, has been probably the most difficult task we have had to contend with. On account of the small amount of funds available, many of the jobs last only a few months, the majority not continuing through the usual outdoor working season, which in our State

is from eight to ten months, and but few of them last throughout the year. Where the work is of short duration, we, of course, so far as practicable use one organization on two or more pieces of construction, but notwithstanding this, we are forced to the necessity to a certain extent of reorganizing our forces each year. We endeavor, as far as possible, by transferring the best men to the longest jobs, to keep a nucleus of foremen and operators from year to year. Sometimes, where it is practicable, we use the county superintendents or foremen in our State work, but it is generally the case that these men are occupied with the county work at the time we could use them.

As to the common labor, we have found it necessary to practically build up a new force annually in each county, though we frequently get back some of the local men we have used the year before.

This is, in brief, the labor situation as we have it in Virginia today, and there are doubtless other States contending with more or less similar conditions. The solution of the problem has not been reached fully by us. As to what we may call the skilled labor, time has helped us much and we have a certain number of trained foremen and operatives which is increasing from year to year and which will in time, I hope, be sufficient to meet the demand, notwithstanding the fact that we lose some of them every year on account of the irregularity of the work. But I must express the hope that in what has proven so far our nearest solution of the common labor problem, we shall never have enough men to supply our demand. Otherwise there must be a great increase in crime. So far as they are available, the convict practically solves the problem for us—with them we have no pay day drunks, no strikes, except now and then an escape, and many of the irregularities connected with the attendance of the free labor are avoided.

There are at work on the roads of Virginia about fifteen hundred convicts. They are divided into forces varying in numbers from forty to seventy-five, according to the class of work they are engaged in. Altogether, there are twenty-seven of these forces, each in a different county. While we may have some labor problems with these, the chief one is eliminated on the work on which the convicts are placed, viz: that of keeping a sufficient amount of labor. We are better able to keep good foremen on these jobs also because they are kept going all the year round. While as a matter of economy we have to close down free labor work during the severe weather of winter, we find it economical to keep the convict work going on continuously, as the men have to be cared for whether at work or not. Certain classes of work can be found to be done in winter, such as quarrying and heavy rock grading in mountainous sections of the State and in the lower sections where no stone is available, the climate is milder and sufficient work can be done to justify the additional outlay for working when both men and teams

have to be cared for in any event. In January of this year 72 per cent of possible working days was made, while in July 90 per cent was made. These percentages are based on an eight-hour day in January and ten-hour day in July. Among the convicts we not infrequently find men capable of running steam rollers, engines, drills, etc., and a large percentage are made trusties and used as teamsters, messengers, etc. The average cost of the convict labor per ten-hour working day for the past three years has been 52 cents, as compared with wages ranging from \$1.25 to \$1.50 for free common labor. To offset this discrepancy in cost to some extent, there are some disadvantages in working convicts, the chief one of which is the necessity of keeping them always immediately under the eye of the guard, thereby in a measure crippling their usefulness; sometimes, too, partially crippled men or semi-invalids are sentenced to the roads, which reduces the general efficiency of the force. Notwithstanding these handicaps, however, these foremen and contractors who have worked convicts under our system very generally express a preference for them over free labor, and I am satisfied they are fully 90 per cent as efficient as the average hired labor. Recently we have had voluntary applications from three contractors for convict labor to be furnished to them and charged on their estimates at \$1 per day per man, which is the established rate when this labor is used by contractors. All felony convicts, not considered too dangerous, and all inmates of the jails are subject to duty in the State convict road force. This force is fed, clothed, guarded and transported at State expense and is furnished to the counties on the requisition of the State highway commissioner as one form of State aid, and is worked under the supervision and direction of the highway commissioner. Under our statutes the convicts are at all times, whether working for contractors or otherwise, under the supervision and control of the State prison authorities, which insures the proper food and treatment and eliminates the possibilities of the many cruelties which have been reported in connection with prison contracts in the past. The men are worked in the open, well fed and housed in sanitary quarters, with the result that they are greatly improved physically and capable of earning a living when discharged.

After a close study of this question and seven years' experience in the work, I am convinced that so far as they are available, the use of convicts in road work under conditions as we have them in Virginia solves the problem of labor in road construction and also goes far towards solving the problem of what to do with our convicts.

THE CHAIRMAN: The discussion of this subject will be continued by Mr. W. E. Atkinson, State highway engineer of Louisiana. I take pleasure in introducing Mr. Atkinson to you.

LOUISIANA HIGHWAYS

BY W. E. ATKINSON

State Highway Engineer

There has been a general awakening in Louisiana to the necessity of better roads. Whether this awakening is due to the extended use of motor vehicles, to the spirit of progressiveness which is now sweeping through the State, or to the special activity of the State through its highway department, it is hard to say; but the awakening has taken place and may be the result of a combination of all these causes.

Nearly every parish in the State has voted a special tax for highway improvement or is about to do so, and twenty-one parishes have applied to the State for aid out of the revenues of 1913. Apportionments have been made to thirteen of these parishes and the department hopes to be able to make apportionments to the others in the near future. The apportionments already made embrace the construction of about 215 miles of highways, to cost approximately one-half million dollars. From January 1, 1913, to September 1, 1913, the department has completed four highways, representing a mileage of 108 miles. There are at this time four highways under construction, aggregating a mileage of about 95 miles.

The act creating the highway department is considered to be a model of State road laws. It not only creates the department, but provides the department with funds with which to operate and with which to lend State-aid, and bestows upon the department such powers and privileges as render the whole system most effective.

These general remarks are made simply to give you an idea of the volume of work being accomplished on the highways of Louisiana and the keen interest taken in this subject. As requested by this Congress, I will now endeavor to tell you in detail concerning convict labor as applied to highway construction in Louisiana and you may draw your own conclusions as to its efficiency.

One of the most effective and interesting features of the act creating this department is the use of State convicts. With us, the greater part of the State convicts are negroes, who, when properly controlled, make very good laborers. They are treated with every consideration, well fed, clothed and groomed, and are made to keep regular hours and to observe all hygienic laws and regulations.

The penitentiary laws of this State are the best of their kind, and permit the use of convicts on the levees and the roads, but always under the care and supervision of the board of control, a State institution. Those not necessary on the farms and plantations owned by the State and operated by the board of control, are sent to work on the public levees and roads. While at work on the levees, they earn revenues for the board of control, as the work is

done under contract at an agreed price per cubic yard. However, they earn absolutely nothing for the board of control when at work upon the roads. The entire expense of their maintenance, while road building, is paid by the parish employing them. With the gratis services of the engineering corps of the highway department, the parishes have an excellent form of State-aid in addition to that secured in a monetary way.

The floods of the last two years caused much damage to the 1600 miles of levees in Louisiana and in consequence, the State found it necessary to withdraw all convicts employed on the highways, in order that the levees could be made safe as soon as possible. Now that this work is completed, I do not think that it will be long before the State highway department will be permitted to use a large force of convicts for highway construction.

About 175 miles of highways have been constructed with convict labor in Louisiana; most all of the roads so constructed were of the improved earth and sand-clay type. While constructing these roads, it was necessary to move camp frequently and the loss of time occasioned thereby, together with other expenses in connection, made the cost of construction just that much more. However, the saving effected by employing convicts as compared to similar work let by contract, is fully 40 per cent and in some instances 50 per cent, and I am of the opinion that a greater saving could be effected in constructing highways of a more permanent nature, which would not require the moving of camp so frequently.

In addition to the cost of maintenance of the convicts, the principal items of expense in operating a convict camp are the salaries of captains, foremen and guards, which are paid monthly, as follows: captains, \$75; foremen, \$40; guards, \$30.

The following figures are taken from the official records of the board of control, State penitentiary:

<i>Average number of convicts employed on public highways 1909—71.3</i>	
Cost of maintenance, per man per year.....	\$68.82
Cost of operating, per man per year.....	82.45
Cost of general expense, per man per year.....	16.91

Total cost.....	\$168.18
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<i>Average number of convicts employed on public highways 1910—147.3</i>	
Cost of maintenance, per man per year.....	\$68.82
Cost of operating, per man per year.....	86.71
Cost of general expense, per man per year.....	16.91

Total cost.....	\$172.44
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<i>Average number of convicts employed on public highways 1911—140.0</i>	
Cost of maintenance, per man per year.....	\$63.70
Cost of operating, per man per year.....	90.85
Cost of general expense, per man per year.....	16.25

Total cost.....	\$170.80
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With proper handling and with the coöperation of the board of control of the State penitentiary, there is no doubt in my mind that convict labor, properly organized and equipped, will prove efficient and economical, as has already been demonstrated in my State. Of course, I am speaking of conditions as they exist in my State, and I am not prepared to say whether this class of labor would prove profitable or economical in other States.

I know from actual results obtained that our department would be able to double the mileage of State highways constructed if we were to use convicts exclusively. Believing that the State would receive indirectly greater benefits and value from roads, I would, if this matter was left to me to decide, place every able-bodied male convict to work on the public roads, until the proposed system, embracing the construction of 4500 miles of State highways now contemplated by the highway department, is completed.

If the convicts were available, and with proper organization and equipment, I believe that 70 per cent of the parishes would avail and tax themselves to maintain a camp of fifty men each, until the roads in their respective parishes were built.

FORCE ACCOUNT LABOR AND CONTRACT LABOR

Now, as to force account labor and contract labor, and to state which is the better, is, in my opinion, a very difficult question to decide. My experience with both methods has taught me to judge each project on its own individual merits, taking into consideration the character, extent and available equipment that could be used in its construction.

Both force account and contract labor have their advantages and disadvantages, and the question of deciding which is the most economical and practical, should, as a general rule, be determined by the engineer in charge.

Work performed under force account oftentimes results in the better and more permanent construction and at a less cost than under contract, and again, in some instances, resulting in more expensive construction, yet invariably as good or better and more permanent than that done under contract. Better work because you are not restricted as a contractor would be to the specifications, but would if you so desired, do extra work and add extra or better material as the conditions require. While employing force account labor, the question of using inferior materials, the desire to rush the work to completion and not giving the proper attention as to workmanship, is almost eliminated.

If the contractor and his equipment are employed under force account, he would not have any motive for substituting inferior material or workmanship, so long as he is getting paid for services rendered. Again, if a contract is taken at a low figure and the contractor sees that he is going to lose money on the job, you will in-

variably have more or less trouble in having the work done according to contract and specifications. Yet, on the other hand, if the work is undertaken under force account with poor or inadequate equipment and inexperienced labor and the work to be done is not sufficient in extent to warrant the purchase of additional equipment or justify the organizing and establishing the necessary discipline, then in that case, contract labor is unquestionably the most economical and satisfactory.

Therefore, I reiterate that each project must be studied and decided by the engineer or owner as to which method is the more suitable and economical.

A contractor bidding on a small project will be inclined to bid higher for the same class of work than if he were bidding on a large project, and notwithstanding the increase in the price bid, it is in many instances advisable to award the contract, for the reason that the amount that would be saved in employing force account labor would not warrant the delay occasioned in equipping an outfit to do this work.

The act creating the highway department in my State is very broad and covers more or less this phase of labor and force account construction. We have in my State, construction work that is being prosecuted under free labor, parish prison labor, force account labor, and contract. All free and force account labor is classified; that is, we place skilled labor on work requiring such and common labor on work requiring this kind, and so on. The State owns a road outfit, consisting of teams, wheelers, scrapers, road machines, traction engine, ballast cars, etc.; in connection with this outfit, we are employing day teams, giving us a larger equipment.

In the parish of Sabine, where the State's outfit and force account labor is in operation, we have a road that is being constructed under contract, also, this work being of the same character and practically the same in extent. The road that we are building under force account, free labor and parish prisoners is being constructed at less cost than the other road of the same character under contract.

In addition to these two roads, we are having constructed in the same parish, another road some eleven miles long, under force account and free labor. We have employed a road grading outfit, paying the contractor so much per day for his teams and labor, but before proceeding with the construction of this road under this method, the department advertised for bids for the work to be done under contract. The price bid on this work was 32 cents per cubic yard. This price being too high, and out of line, the Department rejected all bids and proceeded under free labor and force account, feeling confident that the work—including re-inforced concrete bridges and culverts—could be done at less cost than the price bid.

It is true that free labor and force account labor creates more work for the department and more worry and also makes it necessary to employ more engineer assistants, time-keepers and superintendents.

The department places on each job an engineer assistant and any other necessary assistants that may be required, and he is looked to for results; he in turn looks to the foreman. If the foreman does not deliver the goods, "Out he goes." So far, however, we have had very little trouble with foremen and superintendents, as all of our work has progressed satisfactorily under this method.

The highway department of Louisiana was formally organized February 1, 1911, and although we have studied and solved many problems relative to highway construction, there still remains a number which will require more time and study for us to arrive at a satisfactory solution.

In conclusion, I will state that force account labor and contract labor are both good and it is a question of judgment as to which should be employed. You will note, gentlemen, that we in Louisiana are using both.

THE CHAIRMAN: The subject is now open for general discussion.

MR. W. P. EIRICK: There are just a few of us here and we are here because we are interested. If you will permit me, I would like first to explain why I am here so that you may know that I am interested and that I know what I am talking about. I was county commissioner in Cuyahoga County, of which Cleveland is the county seat, for eight years. During my term of office, almost all of the brick roads in Cleveland were built. I am not going into a discussion as to which is the best kind of pavement; that is for you to consider and determine yourselves. I do not care whether it is a gravel road, a macadam road, a bitulithic road, a concrete road, an asphalt road, or a brick road—what you are interested in is good roads and everyone of them is good, but some are adapted for a better purpose than others. Now we are discussing economics. I say that the question of economics comes in at this point—if you build a good road, Do you get your money back? That is the question of economics. I do not think the question of economics is, Is the money well spent? That is a question for you as taxpayers to demand of your elected officials. The question of graft in public improvements should be set aside, and if it is not set aside, it is your fault as taxpayers. You should elect, as officials, men who transact your business honestly and give you a hundred cents on the dollar for every dollar they spend for you; so the question of economics comes back—not what are you going to do about pavements? If you pave roads, Do you get your money back? That is the economical question. It is the question that comes up before the people of every State on every bond issue. What do we do in our county? When I was commissioner in 1904, Cuyahoga County had a tax valuation of \$240,000,000; it has got a tax valuation now of \$1,000,000,000, not caused by good roads entirely, don't misunderstand me, but on that account also. Cleveland has grown rapidly and

the suburbs have also grown; it has grown out in the country, but what do we do about pavements and the absence of it? I am not here to argue for a brick pavement because we put brick pavements in. You may like macadam pavements or a concrete pavement, it may be more adaptable for your particular purpose or location, but the question involved is, Do you get your money back? as I said before, and I will show you how you get it back. "Back to the farm" is the slogan. The rich man in the city says "I will go out in the country and buy a farm and live there and go home in an automobile;" and a man who stands on this platform and tells you that an automobile is a damage to a good road, makes a serious mistake. It is the automobile owner principally who pays the highest part of your taxation for good roads. He is the man that comes along at the crucial moment and says, if he has made some money in the city, "I will buy me a farm out in the country." And what does he do? Does he buy a farm for \$50 an acre? No, he goes out on an improved road and takes an old piece of land that sold for \$50 or \$60 an acre and pays \$300 for it and it raises the valuation out in that district, and along comes his friend and buys some more of the land. That is economics in road construction. I say that the question at stake in your good roads convention is this, Do you get your money back if you spend it for road improvement? There is no reason in the world why your money should not be honestly spent, but you should nevertheless look over your tax duplicates. I went into the commissioner's office as a layman. I sold logs for a living. I knew nothing about road improvement; I learned it after I was there. My thought was, as a business man looking after the interests of my constituents, Can we get our money back? Not what kind of a road—I was not interested in that side—but, if we improve this road, Can we get our money back? And I said to this man—and there was an engineer from that county who spoke to you today. Give us the road that we need, that is the point involved. Somewhere in the State you want a water bound macadam and should have it. Somewhere in the United States you want a gravel road and should have it. Somewhere else you want an asphalt pavement and should have it; different conditions merit different kinds of pavement, but the serious thought should always be, Do we get our money back? I can take you to Cuyahoga County and show you from the tax duplicates while I was commissioner there for eight years—and I am only out of office two months to go into business—we can show you that we got our money back tenfold before the ten years expired that they paid for these improvements, the tax increase, together with the levy, brought back more than the county put in the road. That is my idea of economics in road construction.

MR. LYMAN: I just want to ask a question, how they take care of those prisoners in the State of Utah? We use prison labor on

the roads, but our camp equipment is so expensive that I don't see how we could move as frequently as these people seem to move, and I would like to know how they take care of those prisoners, what kind of camp they have?

MR. ATKINSON: We have small houses or cages built on four or eight wheel log wagons and we also have cheaply constructed stockades built of rough lumber and logs. The prisoners are also guarded at night. The small houses or cages and the stockades are provided with ample openings and are screened so as to afford plenty of ventilation and be free from flies, gnats and mosquitoes. The work that has been performed under the convict system has been principally improved earth highways. This requires the movement of camp more or less frequently, thereby increasing the cost per cubic yard in grading above what it might cost if the work was of a more permanent nature and the yardage greater, thereby not requiring the movement of camp so frequently.

MR. SMITH (of New Jersey): Do you use the guards to any great extent or merely as a matter of form?

MR. ATKINSON: Yes sir, we have guards and we have to be on the alert at all times. We have trusties among the convicts used as teamsters and drivers in hauling gravel and material; they are also used around the camp as "flunkies" and cooks.

MR. SMITH (of New Jersey): About what percentage do you lose in the way of runaways?

MR. ATKINSON: Why, we lose one occasionally, but the percentage is very small, I would judge about 5 per cent.

MR. SMITH (of New Jersey): In some places they are dropping the striped suits altogether and putting the convicts "on trust." In the South we had to use the guards because the State law compelled it, but in Colorado they even take their stripes off and put them entirely on honor, except in a few particular cases.

MR. ATKINSON: Most of our prisoners are negroes and it is absolutely necessary to have someone to watch them. It is true that we have a few trusties among them, but as a whole, if they are not guarded, they will run away.

THE CHAIRMAN: I might say that in Colorado, they have, of course, been selecting the convicts that they put on the public road. They allow them a certain number of days—commute their sentence so much per month according to the work they do and work them without stripes and without guards. They now have certain convicts that are trying to become available for work in these convict

camps. In a talk with the superintendent at Cañon City, who has charge of the convict camps, I was told that they have had six or eight men try to escape but only one or two ever succeeded. Four of them came back of their own accord, and in the end they got all the men back. If a man attempts to escape, he is taken away from the camp and put back in the penitentiary and all the time that has accumulated toward reducing his sentence is taken away; and he has to serve out his full sentence. Now, if we should try to inaugurate any such plan in the South, we would have to do the same thing, pick out at first a certain number of the convicts, and try it with them and let the others see the advantages that the man who is trusted and put on his honor derives over those who cannot be trusted, and I believe in the end that we can work a large or fairly large number of the convicts in the South in the same way. I might answer your question regarding how we take care of the convicts by mentioning what we have in North Carolina at one of our camps what I call a temporary camp. The camp is located on the section of road to be worked.

This camp, which is located near Bat Cave on the Bank of Broad River, Henderson County, consists of a bunk house, or, as it is sometimes called, a "Cell house" 30 by 60 feet, in the center of which is a double deck platform called the cell, upon which are arranged the beds of the convicts. There is a clear space of 12 feet between each end of the building and double platform, and 6 or 8 feet clear between the cell and the side walls. The space between the two platforms is approximately 5 feet. Each man is allowed a single mattress, so that he has plenty of room for sleeping purposes. Four chains run the length of the platform cell: one each side for the lower tier and one each side for the upper tier. To these chains the convict is fastened by a light weight ankle chain at night. This is so arranged that there is little or no weight on the ankle and he can turn in any position he wishes while sleeping. The construction of such a bunk house depends on the time of the year and length of time it is to be occupied; but it is always built so that there is a plenty of air circulating through the building and that it may be kept warm and comfortable in cold weather. Guards are on duty in this building at night, one at each end.

Near to this building is the dining hall, kitchen and store house. Surrounding these two buildings and enclosing an area of about one-fifth of an acre is a six-strand barbed wire fence. Just outside of this fence at opposite corners armed guards are stationed during the day. At night the only guards are within the bunk house. The sleeping houses for the superintendent, steward and guards are a little distant from the enclosed area. The food supplied to the prisoners is the same quality as that supplied the guards and the steward. It is necessary that pure, wholesome food; clean and well-cooked should be furnished to prisoners, and that is what this camp tries to do.

In a camp of this sort, the men have free run of the building and of the area within the fence during the daytime. We give our men at the present time one week out of every four for good work. As yet we have not been able to arrange to give them any per diem for the work they do, but we, not only in North Carolina, but I think in every State throughout the whole country, are beginning to realize that the work of a State in regard to its convicts is not simply to get work out of them but to make them men capable of becoming good citizens when their sentence is over, and that is the plan we are trying to work on in connection with the work of the convicts in North Carolina. In Virginia and in certain parts of North Carolina, we have men who formerly worked on the roads and who are now foremen in charge of free labor in building roads. In other parts of Virginia and North Carolina we have other men now employed by farmers who watched them at work on public roads and kept track of them when their sentence was over and who came and offered them positions to go with them and work on the farm because they knew they were good laborers. The idea is to build them up and make them men capable of becoming citizens of the community after their sentence has expired, and we believe that is one function of the State with regard to the treatment of its convicts. We believe that the best solution of the convict problem is to work them, where they are able-bodied, on the public roads.

MR. SMITH (of New Jersey): I had occasion to visit a number of the camps in the South and talked with the men, and found that they feel they are being benefited morally, physically and mentally. Physically the convict is very much better off than in confinement and morally he is getting better; they are becoming good citizens, and more than that we are creating a nation of road builders through these convicts. When a man comes out of jail, usually he don't know what to do with himself, but now he has learned a trade while he is doing this work and has a good trade by which he can earn \$1.50 a day as a free laborer. Do you agree with that, Doctor?

THE CHAIRMAN: Yes, sir. Is there any further discussion?

MR. GASH: In Illinois we have just started to use convict labor on the construction of the public highways. We take the men out and put them on their honor and they have been working now something like a month, about forty-seven men, I believe at one place, and men who have been sentenced for serious crimes for a long term of years have been allowed to go with wagons far away from the camp by themselves and the men are all put upon their honor and not a convict has left or attempted to leave the camp. We are going to establish other camps throughout the State, and this, of course, will be extremely economical labor. It will not interfere with other labor in the least, but will be a means of constructing good

roads on an economical basis. If it was not so late, I might go ahead, but I think we ought to adjourn, we have been here long enough. I thank you.

THE CHAIRMAN: I will say in regard to Illinois, I have been very much gratified to get the report that I did a week ago regarding what was being done in Illinois, in working the State convicts on public roads. That is the ideal method of working convicts, putting the man on his honor. When I say putting him on his honor, I mean putting the convict on his honor. We have no guard whatever, no stripes and no man with a pistol in his pocket walking around among them to see that they do not escape.

MR. GASH: The chief thing about that is not only the getting of the good roads, but putting those men out there on their honor—and none have been allowed to go out except those whose sentences were less than five years or whose term of sentence expires within five years. I think that's a mistake; some of the best men for any kind of work that have never committed but one crime and that was murder, inadvertently it might be, in the opinion of the authorities would be the very best men to send out on this work, men who never would commit another crime if they were to get out of prison; but the chief benefit of all this thing, in addition to giving us good roads—that's a mere bagatelle—is that it gives to the men self-respect. The moment you put them out there, they have raised their heads and got their own self-respect, and when they leave the prison, they will leave there, not as criminals, because men are coming down there, manufacturers from Chicago and other cities, and saying to these men that they will give them employment when they get away from the prison, men that will go out on their honor and prove that they have some honor yet in life can get a good position after they come away from the prison; that is the chief benefit of this system to society. If you go into all the States—it will ultimately be the method of reforming those who are so unfortunate in life that they commit crimes and are sent to the various penal institutions of our country. I thank you.

THE CHAIRMAN: The next paper is "California's \$18,000,000 State Highway System," by Austin B. Fletcher, State Highway Engineer of California.

CALIFORNIA'S \$18,000,000 STATE HIGHWAY SYSTEM

BY AUSTIN B. FLETCHER, M.A.M.SOC.C.E.

State Highway Engineer of California

The sum of \$18,000,000 for a State highway system seems huge, but California is a huge State. Its area is 158,360 square miles, and from the Oregon State line on the north to the Mexican border on the south the shortest line that can be drawn is more than 700 miles long.

In their usual optimistic and expansive way, the people having decided in the year 1910 that they wanted a system of State highways, the State was bonded by a referendum vote in an amount which they thought would be enough to build a complete system, and they put no limit on the sum which should be expended in a single year.

ORGANIZATION

The legislature of 1911 passed an enabling act, and in the fall of that year the work was organized and placed in charge of Messrs. Burton A. Towne, Charles D. Blaney, and Newell D. Darlington, constituting the California highway commission, and the writer was appointed to be the highway engineer. Overseeing the work of the commission is an advisory board of which His Excellency, Hiram W. Johnson, Governor, is the head.

The highway engineer was made the executive officer of the commission, corresponding in his relations to the different departments of the commission to the general manager of a large private corporation. Without reference to the public character of this work, the plan of dividing responsibility is along the same lines as if this commission were a private corporation engaged in the business of building roads. The highway engineer has directly responsible to him the following divisions or departments of the work:

ENGINEERING DEPARTMENT

Which is under the working supervision of the assistant highway engineer. The work of this department is divided into eight subdivisions; namely, the headquarters, the division numbers, I, II, III, IV, V, VI, and VII, which represent the headquarters of work in the different parts of the state. Each one of these divisions is in charge of a division engineer, reporting directly to the headquarters office.

PURCHASING DEPARTMENT

Reporting directly to the highway engineer is the purchasing department, which is in charge of all purchases, materials, equipment, etc., and which also has control and direction of the traffic work when the department is transferring materials and equipment from one place to another.

ACCOUNTING DEPARTMENT

Reporting directly to the highway engineer is the accounting department, which is responsible for the records and accounts of the commission. The work of this department is transacted chiefly in the headquarters office, building up from records and reports sent in from the division offices.

FINANCE AND DISBURSING DEPARTMENT

This department reports directly to the highway engineer, and is responsible for the disbursing of all moneys from both the headquarters and division offices.

LEGAL DEPARTMENT

This department reports directly to the highway engineer, and handles all matters in which legal rulings are involved, such as decisions on legal problems that are constantly confronting the highway engineer, and such matters as rights of way, condemnation suits, etc.

The following table shows, classified, the employees of the commission on August 15, 1913.

	HEAD- QUAR- TERS	I	II	III	IV	V	VI	VII	TOTAL
Secretary.....	1								1
Assistant secretary.....	1								1
First assistant highway engineer.....	1								1
Second assistant highway engineer..	1								1
Office engineer.....	1								1
Attorney.....	1								1
Chief accountant.....	1								1
Purchasing agent.....	1								1
Geologist.....	1								1
Division engineer.....		1	1	1	1	1	1	1	7
Resident engineer.....		3		4	6	1	3	4	21
Assistant resident engineer.....		3		4	19	1	7	2	36
Right of way agent.....	1				1				2
Accountants and clerks.....	3	1	1	1	1	1	1	1	10
Stenographers.....	5				1	1	1	1	9
Typist.....	1								1
Messenger.....	1								1
Testing engineer.....	1								1
Laboratory assistant.....	1								1
Asphalt inspector.....					1				1
Blue printer.....	1								1
Draftsmen and computers.....	3	6	7	9	9	5	3	12	54
Chiefs of party.....		2	3	2	1	3		4	15
Instrument men.....		4	3	2	1			4	14
Rodmen.....		9	6	4	3	3	1	13	39
Axmen.....		15	1	3	1			4	24
Teamsters.....			4			1	1	5	11
Cooks.....		3	4					4	11
Totals.....	26	48	31	31	46	18	19	56	275

On day labor work

	IV	VII	TOTAL
Superintendent.....	2		2
Timekeeper.....	3		3
Foreman.....	14	2	16
Enginemen.....	8	1	10
Carpenters.....	6		6
Teamsters.....	41	1	42
Laborers.....	152	5	157
Water boy.....	1		1
Cooks.....		1	1
Total.....	227	10	237

LOCATING THE ROUTES

Eighteen million dollars did not look so large after the commission had made an examination into the requirements of the "State highways" act and the needs of the State, and it was soon understood that the system could not be so expensive as many people expected.

The act, undoubtedly, contemplates, first, the construction of two main or trunk roads, one along the coast and the other traversing the great Sacramento and San Joaquin Valleys; and, second, that the county seats of such counties as lie east and west of the trunk lines shall be connected to the trunk lines by lateral and tributary highways.

The object of the statute, in so far as the two trunk lines are concerned, is by directness to afford a means of communication so that the people of the north may be in touch with the people of the south in the shortest interval of time and space, and at the same time linking together those county seats and centers of population which can practicably, and without materially sacrificing directness, be so joined in a trunk line running north and south through the State.

The laterals are provided for in "State highways" act for the express purpose of furnishing ingress and egress to and from the trunk lines for such county seats as can not practicably be reached by a direct trunk line; and that the ultimate scheme of the State highway system is to cover the State of California with a net work of highways which will compact the whole State for the purpose of intercommunication of the residents of every part of the State, and so that no longer will counties be spoken of as being "remote or inaccessible."

It will thus be seen that the State highway of California under the present legislation at least, will be but the skeleton for the road system of the State, and that local county needs are to be supplied by county systems.

These county systems are being rapidly provided for, and it is no exaggeration to say that before the State highway system is complete the counties will have provided for an expenditure of more than double the \$18,000,000 which the State will spend.

LENGTH OF SYSTEM

It was found that to comply with the terms of the act not less than 2760 miles of road must be taken into the system, which means that the average cost per mile of road built must not exceed about \$6500, including expenses of administration. Since this sum per mile is nearly \$5000 per mile less than some of the eastern States are paying for their State highways, it follows that relatively cheap roads must be built in some parts of the State, and that it will not be possible to pave the surfaces of all the roads.

After months of study the following allotment of the fund was agreed upon tentatively:

Trunk lines

1305 miles, requiring paving, at \$8,620.....	\$11,249,246.00
480 miles surfaced with local materials, at \$5944.....	2,852,905.00

Laterals

785 miles at \$2,881.....	2,261,485.00
Already improved county roads, 190 miles, at 0.....	
Add 10 per cent for administration, surveys and engineering.....	1,636,364.00
Total bond issue.....	\$18,000,000.00

Fortunately nearly every county in the State has agreed to build and pay for the bridges along the State highway routes, and to furnish without cost to the State all land needed for the locations of the State roads. In total such donations amount to many hundreds of thousands of dollars.

Without this county assistance and without the extremely low rate for the haulage of materials which the railroads have granted, the task of completing the system with the sum of \$18,000,000 would have been hopeless indeed.

TYPES OF WORK

For a large portion of the roads the commission has adopted a pavement consisting of a Portland cement concrete base of a minimum thickness of 4 inches and 15 feet wide with shoulders at least 3 feet wide on each side of the concrete. The concrete base is covered with a thin coating of asphaltic oil of special quality and stone screenings, forming a bituminous carpet from $\frac{3}{8}$ to $\frac{1}{2}$ inch in thickness to serve as a wearing surface and to protect the concrete.

An effort is made in every instance to adjust the type of road to fit the needs of the traffic, and no arbitrary standard has been or is likely to be followed.

While the bulk of the mileage now under contract is being built as described above, in the environs of San Francisco and elsewhere thicker bases and thicker wearing surfaces are specified.

In every case the roads are being carefully graded and the drainage is given much study. Briefly stated, the commission has been guided by the following general principles:

1. A re-adjustment of the road locations or rights of way so as to secure proper alignment, and to obviate the necessity for traveling around section corners.

2. Rights of way uniform width, preferably not less than sixty feet.

3. Maximum gradients in the mountainous country of 7 per cent and minimum radii on the center lines of such roads of 50 feet, with all curves opened out as much as possible by flattening slopes and removing brush and such trees as interfere with the view. A clear sight of at least 150 feet should be secured wherever it is practicable.

4. The construction of permanent culverts, gutters and ditches wherever they are needed to prevent water from standing on the roadsides and on grades to prevent gulying due to the water being carried too far in the gutter and thus accumulating in volume.

5. The construction of bridges of a permanent character, preferably of reinforced concrete, such bridges to be at least 21 feet wide in the clear, and so designed that they will carry 16 ton traction engines with a reasonable factor of safety.

6. A minimum width of roadway of 16 feet, which may be travelled safely, such width to apply only to those places in the mountains where there is so much rock as to make a greater width prohibitive on account of its cost. An average width throughout the remainder of the State of 24 feet on embankments, of 21 feet in through cuts and $22\frac{1}{2}$ feet where the road is part cut and part fill.

7. A crown or cross-camber varying from 1 inch to the foot where no surfacing is applied to less than $\frac{3}{8}$ inch where bituminous surfaces are used, in all cases the crown to be the least needed to cause the water to run quickly from the road into the gutters.

8. Such type of surfacing as the needs of the locality require varying from the graded road to the highest type of asphalt paving and varying in width from 15 to 24 feet.

9. The erection of guard rails at dangerous points on grades and on high embankments.

10. The proper trimming of slopes along the road sides, both old and new, so as to prevent the unsightly gashes now so noticeable along the roads. Also the planting of suitable trees, indigenous to the locality, and properly caring for them.

11. The placing of proper permanent monuments at the time of construction along the roads to mark accurately the limits of the right of way. Also the erection and maintenance of guide boards marked to show places and distances accurately.

PAVING COSTS, ETC.

The following table shows the different kinds of paving which the commission had under contract August 1, 1913, together with the lengths and costs. The figures do not include the costs of grading, culverts, etc., nor do they include the expenses of administration.

	MILES	COST PER MILE	COST PER SQUARE YARD
Asphalt on concrete base.....	6.6	\$14,920	\$1.06
Asphalt on macadam base.....	11.5	8,403	0.716
Three-eighths inch surface on concrete base....	198.1	6,394	0.712
Bituminous macadam.....	19.1	6,364	0.723
Waterbound macadam.....	7.6	4,303	0.489

THE THIN ROADS

As will be noted in the foregoing table nearly 200 miles of the State highway is being constructed with a $\frac{3}{8}$ -inch wearing surface on a concrete base.

The specifications for this kind of work provide that the base shall be of a minimum thickness of 4 inches, but discretion is given to the highway engineer to increase the thickness of the base whenever he considers a greater depth of concrete to be desirable.

A base so thin as this would not met the approval of the writer for use in many parts of the country, but in the moderate climate of those parts of California where the work is now under way it will doubtless be adequate for all time. Great care is employed in securing a rigid sub-grade and an effort is made to secure a high grade of concrete.

The concrete is laid without "expansion" joints. It is observed that at intervals of about 30 feet natural contraction cracks develop. These cracks are filled with heavy bituminous material as soon as they are wide enough to receive it. It is believed that with the thin wearing surface it is much better policy to omit the artificially made joints and that the road surface will be much smoother to ride upon because of such omission.

Some objection has been made, chiefly by certain not disinterested contractors, to the thin bituminous wearing surfaces adopted in so many instances by the commission. Derisively, but perhaps not inaptly, they have called the roads "painted concrete."

These contractors insisted that the asphaltic surfaces should be not less than 2 inches in thickness, and that they should consist either of sheet asphalt or one of the "bitulithic" variants. Were it considered desirable to adopt their suggestions, there is not money enough in the appropriation to complete but a small part of the system in that manner and do justice at the same time to the remainder of the State, and the commission has concluded to continue with the thin surface, renewing it so often as is necessary. The thick surfaces would cost more than ten times as much as the thin originally, and it seems probable that the interest on the excess cost of the thick surface over the cost of the thin will pay all of the cost of renewing the thin wearing surface as often as it needs it.

Some of the so-called "painted concrete" has been under traffic about eight months, with a complete satisfaction of all requirements.

MAINTENANCE

The "State highways" act provides that the State highways shall be maintained by the State, and no provision is made for the sharing of the burden by the counties.

To provide the money for the purpose the legislature of 1913 passed a new law relative to the operation of automobiles, one feature of which sets up a system of graded fees for the annual registration of motor vehicles. By the first of January, 1914, when the act takes effect, there will be not less than 100,000 motor vehicles in operation on the highways, and the total fees received will doubtless be in excess of \$1,000,000 for the year 1914. After the expenses of the registering department are deducted, one-half of the remainder goes to a fund for the maintenance of the State highways, the other half being appropriated for the maintenance of county roads. Thus, for the year 1914, it is estimated that more than \$450,000 will be available for the upkeep of the State highways.

PROGRESS OF THE WORK

At this date most of the surveying work has been accomplished on the trunk lines. The laterals also have received due attention, and within a few months all of the surveys preliminary to letting contracts will be complete.

Nearly all of the construction now in progress has been let on the contract basis, but because of the failure of several of the contractors the commission has taken over the contracts in such cases, and those roads are being completed by day labor.

The writer had confidently expected that by this date more than 500 miles of the system would be under contract, but the financial conditions of the country have prevented. The California State highway bonds pay but 4 per cent, and they may not be sold at less than their par value. For some months the bond buyers have looked askance at State bonds paying so little, and although the local bankers have, in a most public-spirited manner, subscribed for more than \$2,000,000, the work of the commission has been handicapped seriously. The total amount of the bonds sold to date is \$4,700,000.

In any event, California will have many miles of the State highway to show her guests who come in 1915 to the exposition at San Francisco and San Diego.

DIRT ROADS AND POLITICS

October 1, 8 p.m.

BY CHARLES P. LIGHT

I am more than glad to see all of you who are here tonight, and I feel that those who are not here will have missed an evening's entertainment that they will regret. I simply want to have your atten-

tion for ten or fifteen minutes while I sort of start this thing off and get you in a receptive frame of mind for Mr. Warren and the pictures that will be shown on this screen tonight, and I want to talk seriously to you a little while, because this Road Congress that is here has met for a purpose, and I want to say to you gentlemen who are in this hall now and who have come here and made this Congress, by your presence, one of the greatest that has ever been held in the world's history. I want to say to you men who are here and who have taken part in the exhibition end of it, you have given to the people who have attended this Congress one of the greatest expositions ever given and it is worth a lot of money to those people who have come here who are road supervisors or city or county engineers or have any official position. You have a commercial interest in it, you are not giving the Congress. The American Highway Association, the American Automobile Association, the Michigan State Good Roads Association and the two dozen other associations associated with them are giving the Congress, but we could not have the Congress without an exhibition of machinery.

My subject here tonight is "Earth Roads and Politics," and the point I want to make is the effect of partisan politics on road conditions or legislative conditions that pertain to road matters in the country. There is not a man in this room who has paid any attention whatever to highway conditions in this country with reference to men who are employed either as State highway commissioners, engineers or in any other position down the line, that has not been affected or who has not realized the baneful effect partisan politics have on various State highway departments as well as local departments. The American Highway Association was organized three years ago and it had two distinctive objects in view, first to see that efficient men were put in charge of the expenditure of road and street funds, especially road funds in the country, and second, that the men in charge should be removed, as far as possible, from political influence. We are not advocating any one kind of road or any road from one place to another; those things will take care of themselves, when we realize that in this country we are wasting, through inefficient systems in the various States and counties, about \$40,000,000 a year. In other words, we have heard a good deal of talk about the Lincoln Highway and the Highway from Dakota to Texas that Mr. Nickerson is interested in; we have heard about the Miami-Quebec Highway. We are wasting enough money annually in this country through having inefficient men in charge of the work or by changing the various departments every now and then, to build the Lincoln Highway and a road half way across this country north and south. This matter is a great economic one and the people of the country are awakening to it in every State. There is more interest in it today than ever before in the country, not only in the United States but in Canada. Just think of it, and I am not casting any aspersions on any man here tonight, but think of what is

happening in the great State of New York; they have changed the heads of the highway department in the State of New York three times in the last four years. Think of it, a great State like New York! Colonel Sohler said last year at the American Road Congress, that the most valuable thing in a highway department was tenure of office, that he had men in his department who had been there fifteen or seventeen years. You take a great railroad—George Panell of the Baltimore and Ohio Railroad, is in this room, and Mr. Richardson, of the Southern Railway; take old Tom Fitzgerald, who was with the Baltimore and Ohio for forty years—why wasn't he fired when Grover Cleveland was elected, and why wasn't somebody else fired who succeeded him when McKinley was elected? It is absurd, it is foolish, and I don't see why the business men of the country will permit this thing; I don't see why they don't unite and do so in the near future, and stop this thing of upsetting a highway department simply because Teddy or Woodrow or Bill is put in. Have an efficient man and keep him there. We have got to take these things to heart and think about the cost. It is costing us a lot of money in the country. There are highway commissioners today in this country who are good men, and I know them and some of you know them, and they don't know today how secure their positions are. It means this, that our engineering schools are turning out men who are not taking highway engineering seriously, because they have no assurance that the positions they get will be at all secure. I want to tell you frankly that it is hard to get today an efficient engineer for a State highway department; I know that, and the time is coming when the office of State highway engineer will be regarded as one of the most honorable and important of any in the State. I come from a State that I am proud of and our motto is *Montani semper liberi*—the State of West Virginia—some of my people are here tonight, but I want to tell you frankly that in the county where I was born and where my people have lived for 170 years, the county changed politics and the complexion of the county court changed at the last election and the man who was county engineer was turned out of office today and two other men who voted the other ticket, were put into office. The objection was raised two years ago that that office was not necessary, and now there are two men drawing \$1900 a year, whereas that man only drew \$700 a year. The man who was fired today ought to have been kept, because he knew about the roads in the county. Take Sam Rice; he has charge of the right of way for the Richmond, Fredericksburg and Potomac Railroad, running from Washington to Richmond, and he told Mr. Page, the president of this Congress, and myself, two years ago, that he had been with the Richmond, Fredericksburg and Potomac Road since 1867, that's forty-six years ago, and as we stood on the back end of a train going to Richmond, he said "I know every crosstie on this road." Of course he was valuable to them. We ought to take it out of politics, absolutely take it out of politics. Now, there

is another thing, a man is never going to make a success of anything nor will he be successful in life unless he believes in what he is doing. I belong to a church that teaches a young man when he enters the seminary, that teaches that young man this one thing the first year—the man that enters the seminary to study for the ministry—experimental religion; in other words, our idea being that a man must first realize a thing, appreciate it himself before he can teach it to others, and as the president of that institution told me once lately, a man has got to burn before he can shine. You will never get any more out of a thing than you put into it, don't forget that you have got to put your life into this thing. A man went to a church to preach for another minister one night and he knew the sexton well, an old man who had lived for a long time in that community. This man used to live there, and after service was over, he talked to the sexton—he had a little girl with him about eight years old, she went back to the door and was looking at a box while her father was talking to the sexton; finally he came to the door and Bessie was still looking at this box and the box had written on it "Contributions," and she said, "I can't make that out, what does it say?" He said, "It means contributions," and he gave her a nickel which she put in the box. The sexton came out about that time and said, "Dr. Smith, we have established a new practice in our congregation since you used to be here; instead of passing the plate, which sometimes embarrasses people because they don't like the one sitting next to them to see what they are giving, we cut out the plate and let every man, as he goes out the door, drop his contribution into the box and his left hand doesn't have to know what his right hand is doing, and whoever preaches here gets what is in the box. I have the key and will open the box and whatever is there is yours for preaching tonight." And he took the key and opened the box and in it there was this nickel and that's all there was in the box, and his little daughter Bessie said, "Father, if you had put more in the box, you would have got more out." That is absolutely true with everything in life, and you men know it. Now I am just as thoroughly convinced that the solving of the highway problems of our country is essential in order that the prophecy that is recorded in Amos and Isaiah—and every man in this room knows what Amos I am talking about and what Isaiah I am talking about, and it reads this way, "And they shall beat their swords into ploughshares and their spears into pruning hooks and they shall not learn war any more." What does that mean? It means the ultimate triumph of agriculture and you cannot have agriculture triumph in any country unless we have the very best transportation facilities it is possible for us to have. Why, this thing of paying 23 cents a ton a mile to haul stuff from the farms to this country to the nearest shipping station and have the average length of haul 9.5 or 9.4 miles. In other words, when we have to put up \$2.16 a ton for each ton hauled on an average in this country, as against \$1.74 to ship that stuff from

that station to New York and then to Liverpool, think how much we are paying for transportation over our roads. We have got to consider those things, we must do it, there is no escape from it. This Congress is going to have a great effect on the country, for this reason, and I want the men who are here representing the various trade and technical papers to hear me; there never has been a meeting of this kind held anywhere, where as many technical and trades papers and agricultural papers are represented and where the results of this meeting will have the circulation among the people who ought to have it, that this meeting will have. I am not going to take any more of your time, because Mr. Warren is here, and I simply want to close by saying this—if you fellows have had as good a time at this meeting as I have had, you have had a corking good time. I thank you very much.

ROAD USERS SESSION

October 2, 10 a.m.

UNDER AUSPICES AMERICAN AUTOMOBILE ASSOCIATION

GEORGE C. DIEHL, Chairman

THE CHAIRMAN: Before introducing the chairman of the morning, there are two gentlemen here from Canada whose company and hospitality many of us have enjoyed, and it is desired that before they return to Canada, that they say one or two words to us regarding a subject which they wish to bring to the attention of the convention, and it gives me a great deal of pleasure to present, first, Mr. Magrath the chairman of the special highway commission of the Province of Ontario.

ADDRESS BY MR. C. A. MAGRATH

Chairman Special Highway Commission of Ontario

I am being presented in the wrong order; my friend, Mr. Campbell who represents Canada, should, in my judgment, be asked to speak first. However, he has insisted that I, as representing the highway commission of Ontario, should address you for a moment or two. We realize that your program is very full, that it is going to take all the time available to get through the subject to be discussed, but I feel personally that I cannot return to Canada without saying how deeply we appreciate the treatment we have received at your hands, and I wish to publicly acknowledge before you our indebtedness, as a commission, to Mr. Carlisle and his associates from the State of New York. We had the pleasure of going to Albany a few days ago, and there is no place on earth that we could go to where we could possibly be better received than at the hands of these gentlemen, and it is due to him that a public acknowledgment should be made on behalf of Ontario. It gives me very great pleasure to do so. Now we are neighbors and we are interested in good roads and I realize that you must be just as much interested in our work as you are in your respective States. I suppose, sir, the greatest compliment that can be paid to any man is to ask him into your home life, into your home and we want to put before you that idea, that you keep in view, probably the year after next, the idea of coming to Canada, to our home, where we hope we will treat you in such a way that you will want to continue to come there. As a matter of fact, there are many of us in Canada who hold the opinion that you

are better Canadians than those born in the country, at least so far as activities in western Canada are concerned. I feel personally that your people are doing more to build up our great country than many of our own; therefore that is practically all I have to say to you gentlemen this morning, that we sincerely hope that you will allow us next year to put before you, in a serious way, an invitation to come either to our national capital, Ottawa, or, say, the city of Toronto, to the capital of the province of Ontario. The question of good roads I am not going to discuss now; you have too much to think of, we like you because of that, and in leaving you, we insist that you must come to Canada and hold a meeting.

THE CHAIRMAN: Mr. Magrath has stated that the Americans are to some extent building up Canada, more than the Canadians themselves. It is a fact that there are one or two Canadians who have done as much to help the road movement in the United States as any American road enthusiast. One of those Canadians who has done that is the next speaker, he has spoken as many times on good roads as many of the good roads men here. The subject has been dear to his heart, he has given it careful study, and the people of the Dominion of Canada and the Province of Ontario have appreciated his great labors in that direction and made him the minister of public works. As many of you have heard him, it is hardly fitting for me to introduce him, as you all know him better than you know me, and I call on the Honorable Mr. Campbell as the next speaker.

ADDRESS BY MR. A. W. CAMPBELL

Minister of Public Works

I just come forward for perhaps a few words by way of seconding the suggestion that has been made by Mr. Magrath. Now I might say that in the Province of Ontario, as in some of your States, the question of the desirability of good roads has been settled. The provincial legislature has appropriated \$5,000,000 to be expended in connection with the work of road improvement to aid the different municipalities in carrying on that work, but how best to make that expenditure of course is a very great question. The money is there, they want to spend it, but they don't want to waste it and they want to see that every dollar that has been expended or appropriated will be expended so as to produce a dollar's worth of results. Now, for that purpose, Mr. Magrath and his commission have been appointed by the legislature to frame the most desirable plan that can be laid down to govern that expenditure, and that expenditure will be made under the direction and supervision of this commission, outside of any other influence whatever. We do believe that when this commission makes its report, that these recommendations will be of

such a character as to assure that even better roads will be built in the province of Ontario than are now being built in the adjoining States of New York and Massachusetts, from which we have taken so many lessons. New York I suppose has been, and Massachusetts has been a pioneer in this direction, and we watch every mile of road, you might say, that they build. We study how they build it, what the result is, and then we try to avoid some of the mistakes which they have made, and in that way we receive a very great deal of benefit from the very free information that is always given gratuitously by Mr. Diehl and his commission. Certainly we do admire the work that has been done there and we watch them closely. Now then, when this commission has made its report, we expect in the province of Ontario, that that money will be so expended as to make some of the most up-to-date roads on the continent of America. Now the Dominion government is willing, as soon as the provinces are in a position to handle the expenditure fairly, to make an appropriation there, and we do not question how many millions it is going to take, we are not thinking about that at all; what we want is a competent plan for the expenditure of the money and then we will make State roads and National roads and good roads. We are working at this and we now have many miles of very good roads. We have one or two cities over there that are bright, prosperous, live cities, with all the accommodation that is necessary, almost equal to that of Detroit for entertaining a congress such as this. Geographically we are favorably situated, and we came here designing to capture this convention, if possible, and bring it to Canada next year, and if it is possible, to affiliate ourselves with you so as to absorb some of the extremely valuable information which is disseminated at these meetings, but we find that there is already on foot a very live, healthy, active campaign among one or two of your cities for the convention next year; consequently we think we are defeated and we are going to give you advance notice that at the next annual meeting of your congress, we are going to make a more strenuous fight to have the congress held in 1915 either in the city of Toronto or the city of Ottawa, where we will give you a right royal good welcome, a good time, and possibly give you or assist in giving you some information that will lead to the betterment of your roads and our roads.

THE CHAIRMAN: I am sure that if we could put the question now we would all vote to go to Canada. The only trouble would be, I warn the honorable minister, if he ever gets us there, he will have hard work getting rid of us; we are apt to stay a month; I know, because I have been there before. You all know that New York is spending more money for highway improvement than any other State in the United States, or I think I am safe in saying, it is spending more and has more to expend than any country in the world. There are results in New York of which we are proud and

others of which we are not proud. The reason for some of the failures has been the frequent changes in office by reason of frequent changes in State control. The State started the road work fifteen years ago, and since that time there have been nine changes in administration. When the present executive of New York was elected, he looked all over the State to find a man to put at the head of the highway department whose standing would insure to the people of New York an efficient and economical and wise expenditure of public money. The scandal resulting from mal-administration had so forced the good roads question into the public eye that the people were aroused as never before to the importance of the work of the State highway department, and the governor selected a gentleman who had been known for years as a public spirited and patriotic, a live and energetic man who, in the northern section of the State, was looked upon as the one best versed in public affairs, and it was to the great satisfaction of all the people throughout the State that he selected a man who was so good an executive and so careful in his methods as to insure a proper expenditure of the highway funds. It is with some little embarrassment that I speak in these glowing terms of the chairman, as he once in a while allows himself to be controlled by friendship rather than by sound business principles, and when he appointed Colonel Washington, the handsome gentleman at my rear, and myself on the advisory board, he committed one of these errors of judgment and acts of friendship, and I do not want anybody to think that I am returning it by trying to say something about Mr. Carlisle; because he deserves all I can say of him and a great deal more, and it is a great pleasure to present, as the chairman of the morning, the Hon. John N. Carlisle, chairman of the commission of highways of the State of New York.

ADDRESS BY JOHN N. CARLISLE

Chairman Commission of Highways of New York

When we have completed in New York State the type of roads we are going to build and open up to the people of this world the possibility of their being able to come to our State and take in all these diversified scenic effects, there is no doubt but what we are not yet able to appreciate the wonderful, tremendous influx of travelers that will come into New York State. Next year, by December 31, 1914, we expect and I believe we will be able to complete practically the great through routes of New York State, so that you gentlemen from the west can come into New York, can go to Buffalo, from there you can go through the cities of Rochester, Utica and Albany, down the Hudson River to New York, or you can turn and go by Lake George and Lake Champlain to Rouse's Point into Canada, if you desire and come back down to the Great Lakes and Buffalo, or you can take route No. 4, and, by an entirely different route from

what you came from the west going east, you can go back through the entire length of our State. Now these problems in New York State, as you see, are very hard problems to solve but very interesting, because of the different types of roads that we have to construct. We have the ocean sands on Long Island that call for one particular type of road. We have near there the largest city in the United States with a tremendous automobile traffic that comes out of that city, passing over those roads. We have, in northern New York, our heavy clays and in the southern sections our shales. We have tremendous valleys where but one road can pass through, where we cannot build full width roads, and we have our mountain sections, where we have to climb them by divers routes in order to get up through those mountain passes; so in the State we are in a different situation, somewhat, from what you gentlemen are in the western States where you have a flat country and the same kind of soil all over the State. We are confronted with every condition of soil and different characters of roads and great climatic changes. The southern part of our State is, in a way, remarkably mild; the northern part has very severe winters, and to design roads which will stand up is a very great problem to solve. When I was appointed, I determined that if there was any way in the world we could solve this problem before we started again on the expenditure of this large amount of money, we would try and solve it in an intelligent way. The legislature in 1913 had changed the law, abolishing what was then a commission in New York, and provided for a single headed commissioner and to put upon one man the expenditure of this large amount of money, was a proposition that would make any man tremble to tackle it, and I insisted on the appointment of an advisory board of engineers that would take up with me these problems, and I think I was very fortunate in the board. I got Mr. Diehl, who had been county superintendent of Erie County for a good many years. It didn't make any difference whether the board of supervisors was democratic or republican, they always took Diehl. I went to Massachusetts and got Mr. Parker and I got Colonel Washington, of New York, and we started to go out over New York State from one end to the other to try and study the problems relating to our State so that we would know, in each section, what we were up against, what confronted us with regard to problems of traffic, what type of roads we ought to build, taking into consideration the locality, the material available for constructing roads in those localities and the probable demands upon those roads in the near future in connection with the traffic which is bound to come upon good roads the minute you complete them and open them up and this advisory board has been working all summer long. When I get back to Albany, I expect to get their report and know that every single man here will be interested in it, because in that report we are trying to work out practically an entire reorganization of the highway department of the State of New York to put it upon a

plane of efficiency that we think and hope will result in our being able to solve the problems in our State. Today New York State has 4000 miles of improved roads, already built. These roads were constructed a number of years ago, some of them; they were constructed when nobody anticipated the traffic they now have to bear, and it is a problem, not only of the maintenance of those 4000 miles of road, but the great problem is that we have to rebuild a good many miles of roads because the roads were built several years ago and what was then a proper type of construction will not stand up now, and to show you where the maintenance problem comes in, the highway department, in order to maintain 4000 miles of roads in New York State, asked the legislature last year for \$7,000,000 to take care of maintenance alone. They gave us \$3,500,000 for maintenance on those roads in New York State, and that amount is not sufficient to properly maintain those roads to the degree of efficiency we desire, and take care of the rebuilding of some that have absolutely gone to pieces and are now in a shape where we cannot repair them and any attempt to do so would simply be foolish. We are now building 1600 miles of roads in New York State outside of the 4000 miles already in construction. Those contracts involve \$20,000,000 and our payments to contractors in this month for construction work in New York State in the month of August amounted to over \$2,700,000. The payroll of the department in the State of New York is over \$1,200,000, and besides that we are paying out to the poor towns, to help them in building their town highways, over \$2,000,000 so that the problems that relate to New York State are problems that are so vast that I knew I was justified in the appointment of an advisory board and I know I am going to be justified in the entire reorganization of the department from beginning to end. In our State, under the old law, we had six divisions with a division engineer in charge of each division. Our maintenance was separate from our construction; a different force handled maintenance and construction. Under our proposed scheme, we are going to have nine divisions in New York State, each division of which will be larger than the State of Massachusetts, and spending more money in construction in the next ten years, and in maintenance than many States do, so you can imagine the problems that confront a division engineer in New York State with the building and upkeep of these good roads. We are not afraid of construction; we think we are going to be able to build types of roads, taking into consideration what science has taught us up to date in regard to road-building; the great trouble is maintenance, to keep those roads up to a proper degree of efficiency, and when New York gets through building its system of 12,000 miles of roads, the maintenance problem will be a very important one and it must be studied now to see to it that when we spend this enormous amount of money in building these roads, we don't let them go down to where they will be a disgrace. Today the people demand efficiency; they demand of

those who hold public office and have charge of public work, that that work shall be done efficiently. Now, our system in New York is somewhat unique, and I think a good many of you gentlemen here who have been talking about the problems and the way to handle roads—possibly we may have figured out a pretty fair scheme in connection with it. We first have a system of 4000 miles approximately, of State roads that were laid out by the legislature of New York State, and under the last referendum, that particular 4000 miles, 3800 and some miles, must be built as laid out on the map. We build those roads, pay every dollar of the cost of building them and of maintaining them, so we have on our map, as we call it, our State routes numbering 4000 miles, then we have a system of what we call county highways, and these are roads laid out by the boards of supervisors of each county in the State, for the department at Albany has the veto power as to whether or not they lay out a proper system of connecting roads. Thus county highways of 8000 miles are built in the same way as the State routes, that is the departments at Albany builds the roads and maintains them, but the counties pay a part of the cost of building those roads, and that cost runs from 35 per cent down to 9 per cent, and the difference in the cost which the county pays toward the building of a county highway depends upon the population of that county in connection with its area and mileage, so that in all the counties of our State where we have a city, the county pays 35 per cent of the cost of building those county highways, and in counties where there are no cities and the population is small and the assessed valuation is light, it varies until in one county, Sullivan, the State pays 91 per cent of the cost of building the highways of Sullivan County and the county pays 9 per cent. This county money is paid by the county as a whole, not assessed upon the towns or individuals, but the county itself raises its share of the money to build this system of county roads, and we maintain and build the roads exactly in the same way and by the same men as our State roads, and in regard to maintenance, the towns in which the highways are located, pay \$50 per mile per year for maintenance, which is a mere bagatelle so far as the cost is concerned, at the present time. Besides that, we give directly to the towns themselves this year \$1,781,000 of money. In this way, if a town raises \$1500 of money to improve its town roads outside of these county and State highways, the State of New York pays directly to the town board \$1500 and duplicates their money. There is a divergency there. If a town is a rich town with a small population, we don't give them as large a percentage of money as we do a poor town with a large population, but it practically means that every one of our towns in New York State, the State, by means of a direct payment out of its treasury, duplicates the money that the town raises for good roads, and because of the fact that we duplicate the money that the town raises, we have, in a way, a supervisory scheme of looking after the distribution of that money in the towns.

We have a department under the charge of a deputy known as the bureau of town highways, who travels around the State with a corps of inspectors, advising the county or town superintendents as to the proper methods of taking care of their purely town highways and bridges and culverts, and I want to say there has probably been no better work done in New York State today than has been done in the last five or ten years among the poor towns of the counties and in the typical cross roads towns of New York State by means of supervisory work done by county superintendents under the supervision of the department at Albany and by the helping of these poor towns by a direct giving of money to them for improving their roads. This money is paid directly to the supervisors of the town and the town board can disburse it in the building of roads, bridges, culverts or any other method they want to adopt, so you see the activities of the highway department of New York reach out to and cover every road in the State of New York, and our mileage there is about 80,000 miles. In regard to bridges, a wonderful development has taken place there. You all know the bridge game in the past. I know one town alone, when I went with the third deputy, there was a bridge 135 feet long built seven or eight years ago, and we took care of it by seven-foot culverts. Under the law today, no town can buy a bridge unless the county superintendent at least approves it, so we have got some kind of a check in New York State upon the policy of building these tremendous bridges over streams where they are absolutely not required at all. In addition, if any town wants a bridge built and they apply to our department, we will prepare the plans and specifications without charge and furnish them either for the building of a culvert of concrete or a steel structure, so we have tried to work out in New York, and I think fairly well, not only the scheme of taking care of what a good many people criticize as the building of roads simply for the automobile and the rich man, but we have gotten up a scheme that reaches right down to and gets upon every road in our State, no matter how small it is or how poor a section it is located in, and in some way try to get them to improve their local town roads in the backwood, as we call them. Now we have also located at Albany, and I think that is an important thing for you gentlemen to take up, a bureau of tests whereby not one particle of material can go upon a road in our State until that material is tested in our department at Albany by our own men. No tar, no asphalt, no cement, no stone, no sand, nothing whatever of any possible nature, gravel or anything else can go upon our roads until that material is tested in our own department at Albany by our own men under our own supervision, and I want to assure you that it is a wonderful advance in regard to road building when you know that the materials that go on a road are materials that are going to last, or materials that are not going to pieces within a comparatively short time, and that is one of the most interesting subjects we have, and we are now having a man

travel our State from beginning to end who is doing nothing except looking into the problem in regard to materials for road construction, finding out every gravel bank there is, sending the material to Albany and having it tested, and there is not over half the gravel that will stand the test we require. Lots of gravel, when subjected to the test, will not stand up and we won't permit it to be used. We test all the sand and we are trying to locate all the stone quarries in New York that may possibly be made available for construction, so that we can tell our contractors "You can get this material at a certain place." We are trying to get options on these stone quarries and gravel pits, so they cannot be held up for any exorbitant price, and I submit to you gentlemen who have charge of State work, that one of the most important factors that you ought to get into, no matter how small you get into it, you ought to have at your headquarters some kind of a bureau of tests whereby you yourself know without taking anybody else's word for it, because this highway game has pretty nearly developed in a highwaymen's game in a good many sections of the country, and you have got to be careful and know that what you put into the road is what you want to put into it and not what somebody else wants you to put in because he's got something to sell. We have put that department on the basis of a very high degree of efficiency, and one of the greatest advantages is the knowledge that when we build our roads in the future, we are going to know, when we put any material into the road, that that is material that we believe will effectively do the work it is called upon to do. In our State, the maintenance problem, as I said before, is the great problem. We have tried to take care of it in the past by a patrol system, that is, we have assigned men an average of about five miles of road each. Those men go upon these roads; they have a horse and cart and are supposed to look after the road, but we became convinced that the patrol system does not bring the results which we want to have for the expenditure of that amount of money. Our patrol system in the State of New York this year cost us \$600,000, and I think we might as well have taken about \$500,000 of that money and dumped it in the river so far as results are concerned, and we are determined in the future to try and handle this question of maintenance on an entirely different basis, organize section gangs of men and try to follow the policies adopted by the steam and street railroads in the methods by which they keep their property up. They would never go back to a proposition of putting a man in charge of five miles of road and expect every man to have their lines kept up. We will organize section gangs and give them a steam roller, an automobile truck and any other equipment necessary to let them go on these roads and put them in the shape in which they ought to be maintained, and we believe in New York and are very hopeful that by means of the advice given us by the advisory board and the new specifications we expect to put in force within a week for the building of our roads in the future, we are going to be able,

we hope, to solve the problem a little bit better in New York, whereby we can build good roads, maintain them, keep them up to the proper degree of efficiency required by the people and try to give the people a dollar for every dollar that is spent.

(Mr. Carlisle then took the Chair.)

THE CHAIRMAN: I have the pleasure of introducing to you a distinguished citizen from the western part of the United States who has been interested all his life in good roads and who is going to speak to you upon the national old trail roads, Judge Lowe of Missouri.

NATIONAL OLD TRAIL ROADS

BY JUDGE J. M. LOWE

I am almost always introduced and assigned to that subject and rarely ever touch upon it except incidentally by way of illustration. I ought not to be and seriously protested against being called upon this morning to again address this convention. I had the pleasure and the honor of addressing you the other day, the first day of the convention. I am on the program again tomorrow, Michigan day, and so I am liable to become stale and unprofitable; you will get tired of hearing one man talk too much; but as it is insisted upon, if you have the patience, I believe I have the nerve and the courage to talk to you for a few moments, and in the beginning I will supplement, for a purpose, the splendid address just delivered by your chairman, Mr. Carlisle. He was dealing only with one phase of the question, and that a practical one in the State of New York. He did not tell you, as I now tell you, that 80 per cent of the \$100,000,000, at his disposal in the State of New York is paid by the city of New York. I am saying that to my farmer friends. The time was in the history of road legislation, that the farmer was unduly burdened with road maintenance and road construction. In the evolution of events, that is no longer true and it ought not to be true. The cities, the towns and the villages are using the public roads now as they never did before, and they ought to help build and maintain them and they are doing it willingly so far as I know. New York first voted \$50,000,000 of bonds. There was some criticism on its expenditure and it was not sufficient. They submitted another \$50,000,000 proposition. The first \$50,000,000 was carried largely by the vote of New York City; the farmers pretty generally voted against it. Notwithstanding their experience, when it was submitted the second time it was carried almost unanimously. Now that \$50,000,000 bond proposition is pending in the State of Pennsylvania and I understand they have expressly exempted farmlands. That is wrong, absolutely wrong, if that is true. No kind of property

ought to be exempted from an equitable division of the burdens of taxation, especially for great internal improvements, but they will carry it, I hope, and expend it wisely. Now, in Missouri, where I come from, we submitted a proposition authorizing and empowering the county courts to levy 25 cents upon the \$100 of valuation to raise a road fund. Most of our people in the rural communities voted against it. I am a farmer myself and have a right to talk about it. We are naturally shy. I am not an automobile owner, either, and have a right to talk about them; I don't know whether I ever will be an automobile owner or not. I am not connected in any way, shape or form with any commercial interest under the sun, and never have been, so that I am a free lance on all these questions and can afford to tell the truth, if I know what it is. Now we shied naturally at increased taxation and voted against it. Kansas City and St. Louis carried it and adopted it, with the result that in Jackson County, Kansas City pays 95 per cent of the road taxes which are building a magnificent system of highways in that county. They had not yet realized that this movement means that the cities, the towns and villages, the merchants, the manufacturers, everybody shall contribute to the building and maintenance of the roads of the country. Now let us utilize that situation, make the most of it, and when these propositions are submitted to you, let us meet them half way. Now, to clear up some mystification that is thrown around these questions in this convention, the future historian will enjoy himself when he comes to write the history of this great movement, at the rapid progress it has made and the peculiar psychological growth of the road subject. I began just where some of the speakers at this convention left off a year ago, in believing that the national government ought to take a hand in this great movement on condition that the States and the counties contributed their share. My God! haven't they contributed their share? Whose money is this about which we are talking? Where does it come from? It is a false idea, a false conception. The national treasury is not distinct and separate from the State treasury except in the ingenious manner in which the taxes are collected; that is all, and you are contributing every time you turn around, to build up the national treasury, doing it unconsciously. But some of them seem to have the idea, that old miserable, worn out idea, that there is some kind of antagonism between the national government and the State government, and some of them will say "Let's do this, let's insist that the government do it provided the State will do so and so," and we will send—they used to call them ambassadors—from the States, the Senators, the ambassadors from the States, to work upon the general government and plead with it for a part of our own money. Now, that is an altogether false conception of the powers of government, of the duties of government. My theory now is, and if it is not yours, it will be, because I have traveled exactly over the same road that some of you are still traveling—I listened to a tremendously

distinguished and highly accomplished and educated—a real statesman—the other day, and I said “Why, he is fine,” and still he is growing rapidly, he is now in the kindergarten class, he will graduate by and by and be an out and out national road man; there isn’t a shadow of doubt; it is like a Texas steer, if you once get him in the chute and prod him, he will go right on. Just one other idea; I have been sitting on this rostrum here and this thought occurred to me; there’s the greatest highway in all the world, I don’t except any, right there. Why not turn it over to the State of Michigan? Why not let Michigan take care of that great highway and control it? Can you, for the life of you, draw a distinction between that highway and any other great national highway in this country? The Supreme Court of the United States has said recently that there is no distinction under the commerce clause of the constitution, no distinction between transportation by water and by land. Congress has found no difficulty, no constitutional difficulty, in contributing more than \$600,000,000 to the water highways of this country, to the rivers and harbors, more than half of which has been wasted; but when you ask them to contribute something to the building of national roads, they at once meet you with the proposition that we are in favor of doing that provided you will contribute an equal amount. We will let you have some of your money if you will raise an equal amount with what you have already paid. You did not resort to that in the passage of the rivers and harbors bill; neither did you when you voted away more than 200,000,000 acres from the public land States of this country to the railroads. I ask you and I am going to continue to ask you, where do the railroads of this country stand on this great question? Are you with us or are you against us? If you are behind the Shackleford idea, then I know where you are. I know where you have been on the rivers and harbors legislation of this country, but if they can, this question will be put just where the rivers and harbors legislation has been for the last fifty years—in the pork barrel. They have kept it there and I know why, and I know that that is the scheme in Congress now. Why, when we passed a resolution through the last Congress in Washington in favor of appropriating national revenues to the building of a system of national highways, it was moved to amend it by turning it over to such roads as Congress might decide in favor of. What did that mean? It meant, we will take this money, we will vote in favor of this appropriation provided it is distributed among the congressional districts. Now they take offense, some of them, at the statement that they are pork barrel statesmen. Let me show you—and I quote their own figures. Suppose Congress should decide to appropriate \$3,000,000 to the building of a national highway across the State of Missouri, about 300 miles. At \$10,000 a mile, it would cost \$3,000,000. If, instead of doing that, they would turn it over to the State legislature to be parceled out among the counties, it would give \$30,000 to each county, with that they

could build just three miles of road in each county. Under the other plan, they would build one great highway, at least, clear across the State. Suppose they built eight roads? Then the government would have built 2400 miles in the State; at \$10,000 a mile it would come to \$24,000,000. That amount, divided up again among the counties would give \$240,000 to each county, or 24 miles of road in each county. Twenty miles is an average across each county. The nation, under that principle would build 160 miles of national roads, while under the Shackleford idea, if the money was distributed and all of it put into roads instead of into the pockets of a lot of road officials for political purposes they would build 24 miles of road instead of 160. Now that is it exactly, brother. I am a conservative of the conservatives, yet they talk about me being a radical, every once in a while. Mr. Shackleford says that in five years he proposes to build a million miles of road with the national revenues. What does that mean? At \$10,000 a mile, that means an appropriation of \$10,000,000,000 in five years, \$2,000,000,000 annually. That means, if it means anything, absolute national bankruptcy. Why, there is not a government on earth that could stand such a scheme as that. Now that is enough to say about that; I dismiss him and dismiss his idea and consign him, together with the Congressmen who stand by him—and I know most of them—to that oblivion which he has so richly merited. Now I will talk just a minute about another Senator's scheme, and they say he is a financial wonder, a financial genius, Senator Bourne. These played out politicians, when they lose out at Washington, they go to work and get on a committee. They made him chairman of a joint committee and he has got up a scheme for national aid, federal aid, and I want to tell you in a nutshell just what it is. He says that if any State—and he has prepared a table showing us how much we may expect under that, I don't know what Michigan would receive under that, I expect about \$25,000,000, but before she can get a dollar of it, he proposes that the government shall issue bonds to the extent of \$3,000,000,000. Do you know how much that is? I don't. I haven't the faintest conception and neither had he—\$3,000,000,000—and sell them. Lord! I wonder where he would find a market for them—3 per cent bonds, and then let the States issue 4 per cent bonds and pledge those bonds as collateral to remain in hock for fifty years. Now, my farmer friends, you see where that lands you.

A DELEGATE: I'm not in favor of that scheme.

JUDGE LOWE: Of course you're not, and no other level headed farmer under the shining sun is in favor of it and never will be. Just work out that scheme. We put up, in the State of Michigan, about \$25,000,000 4 per cent bonds and he says—and the magazines of the country have commented on it favorably and have said "Why, at the expiration of the fifty years, they cancel the bonds,

the government does, cancels the State bonds and hands them back." True, and they think that is an act of great magnanimity. Great God! why not, when the State had paid the bonds twice? Count it up, 4 per cent on \$25,000,000 for fifty years is \$1,000,000 a year, isn't it? \$25,000,000; \$1,000,000 a year; in fifty years you have paid off your \$25,000,000 and paid it to the government, because you have paid the interest on its bonds in the meantime, and the bonds ought to be canceled, oughtn't they? But what else does it do? It ties you up for fifty years, perhaps exhausts your bond voting power and you cannot anticipate. This scheme won't work unless you take it for fifty years. Now, if that is national aid, may the good Lord deliver us from any national aid, and let me just say a word on national aid; that is the most wretchedly misleading proposition under the shining sun—national aid, federal aid. I used it for a while but have cut it out of the literature of the Old Trails Association absolutely; we never use it, because it is absolutely misleading, and we don't ask federal aid. If a road ought not to be built because it is right, because it serves a great national purpose, then the national government has no right to lend its aid to the building of any such road. Old Jackson was right. He was sometimes wrong, but he was pretty near always and Clay was pretty near always right; but Jackson was right on that proposition when he vetoed the Clay bill. He said "Your road is a local measure." Mr. Lincoln, in discussing that question said, "It is true that scarcely any improvement is so local in its character as to be of no general benefit, and that is especially true of a road proposition," but unless a road is of a national character, I maintain, I don't care what powers you may have under the constitution, maybe you have the right under it, to appropriate this money indiscriminately, but I do claim that the correct policy is to appropriate the public funds for public purposes and no other. Now let us stop taking about national aid and let us go to the government and say, "Build a system of national highways and maintain such system." That is the correct doctrine. When you do that, you need not appeal to the States to share in that great effort. You need not go back to the States with your ambassadors and ask them to negotiate with them; you do not even have to ask the right of way. I have made tremendous progress; if I had very much States' rights in me, they shot it out of me in about four years; they gave me a devil of a walloping. I have been reconstructed ever since. I don't shy at any of those questions. The national government has as much right to build a highway across the State of Michigan as to build and improve that highway out there [pointing to the river].

Now I have scattered around over questions enough to make you talk until the next annual convention. My subject for tomorrow was to be "Storm Centers to be Avoided in the Campaign for Better Roads," and I am going to say a whole lot about avoiding these storm centers, and here I have been setting up about a dozen of them

myself. Now Gentlemen, let's get together, and that is the thing we can do and ought to do. There are several questions closely related to the ones I have mentioned that I would like to discuss; if it was not for taking up the whole forenoon, I would do it, but this is enough, let's keep this; if we are going to build any roads in this country, let's stand for a system of national highways built, supervised and maintained by the government; a system of State highways built, maintained and supervised by the State and by the counties and the townships. Then we will have a system of roads that will be worth while. Then we will have roads that go somewhere, not like your roads around Detroit, you've got some splendid roads, but we didn't get three miles outside of the city limits of Detroit before we plunged off into the mud, and I wonder what became of that gentleman who said that earth roads, natural roads, were the best? I wish he was here today; I want to go out with him; I want him to see some of these roads right here near Detroit; that may be so down in North Carolina, where the tar heels all live. I don't know, I never saw them, I expect it is so because he is a fine fellow and he said it was so, but I would like to see one of them; you'd have to show a fellow from Missouri. Now, if we get behind a uniform plan and stay by it, those fellows at Washington keep their ears to the ground all the time, they are watching the situation and are ready to act and going to act, going to do something, preferably so they can go back home to their district and say, "Just look what I brought you." Now, I thank you gentlemen and will give way to somebody else.

THE CHAIRMAN: In all of these movements there can be no success attained unless everybody joins in them, and among the people who are now most interested in good roads, naturally interested in the good roads problem, I consider are the men who work and toil upon the farms of the country. They have a representative here, one of their own men who is high up in their order, and I have the great pleasure of introducing to you Mr. N. P. Hull, of Diamondale, Michigan, who will speak upon the subject, "The Farmer and the Road."

THE FARMER AND THE ROAD

BY N. P. HULL

This morning I am a good deal like a certain fellow down in the State of Ohio—you people will appreciate this—I guess you have all heard of the excellence of the clay roads of Ohio in a very wet time. This fellow was going down those roads, one of the worst ones, afoot. He had on rubber boots up to his hips. He got in a very bad place and stopped to look the ground over. He felt

one foot sinking; he changed his weight over onto the other and tried to pull this out, and the foot on which he placed his weight went down as far as the other came up. He worked that way for a long time there and a gentleman who lived alongside the road saw him there and went out and said, "What's the matter? Are you stuck?" And the fellow says, "Yes, and it is the worst sort of a stuck, too, for I haven't anything to unload." I am somewhat in the condition of that man this morning, that is, I haven't very much to unload. The officers of the A. A. A. wrote me about a week or ten days ago and asked me to talk here this morning and say something from the farmer's standpoint, but they did not say anything about what the topic was to be and I did not know the subject I was to talk upon until I got here this morning, so I have not had a very large opportunity to load up so as to have anything to unload upon you this morning. Now I am not going to try and contribute so many new thoughts to this matter. What I say, and I'm not going to talk a great while, will be more along the line of a rehearsal, but I feel justified in that because no great movement has ever come to its full conception without rehearsal and re-rehearsal. We must talk these things over and talk them over again before we can all come to a conclusion or before we will all see anything like the full field we are to consider, and at rehearsing, I am pretty fair; at original thinking, I am not so good. It has always been rather easy for me to talk, in fact I never got stumped but once; I will have to tell you this little incident—I wish you wouldn't take this foolishness down—to show that even a man who talks a good deal will once in a while get stumped. I visited a friend of mine over in Massachusetts some time ago, and in the evening, knowing I was quite a hand for amusement, he says, "Hull, they are going to have an entertainment over at the Institution tonight; would you like to go?" I said, "What kind is it?" He said, "It's the deaf and dumb asylum." I said, "Yes, I am in for most any sort of an entertainment." So we went over. We got over there and it turned out to be a dance. I stood and watched those dancers and among the young ladies dancing there were two or three very beautiful girls. I watched them for a while and said, "Jim, it's too bad these girls are deaf and dumb; there are some pretty girls among these deaf and dumb people here. Do you know that if that girl right over across there (pointing out one) if she wasn't deaf and dumb I would like to dance with her myself." He says, "That won't make any difference, her being deaf and dumb, she can dance just as well as though she wasn't." I says, "Yes, I can see that, but I can't ask her to dance, because I don't understand this finger language." He says, "I can fix that for you; I can talk the finger language well enough to introduce you, and these girls get to understand the language of motions clearly; so you just go over there and make the right sort of motion and she will know what you mean." I says, "Yes, but I don't know what kind of motion to make."

He says, "You look right in her eyes and make a motion like putting your arm around her waist and she will know what you mean." He took me over and introduced me; I looked her in the eye and made a motion like putting my arm around her waist and then I girated around the floor. She assented and then I thought again how really sad it was that that girl was deaf and dumb, because I could think of a lot of sweet things I'd like to say to her. Just before the music started, a fellow said to her, "Come Grace and have a dish of ice cream with me." She said, "I'd like to, but I promised to dance with this dummy." Now seriously, just a few words in regard to this great road proposition from the farmer's standpoint. While I did not hear Congressman Shackelford the other day, I know the Congressman pretty well, I have talked over this matter of good roads with him, and I noticed he stirred matters up here the other day and that even Judge Lowe, from the same State of Missouri, does not agree with Mr. Shackelford. If these men from Missouri that have to be shown, don't agree, of course it is easy to conceive where others of us may not agree. I don't believe that the farmers need necessarily disagree in the matter of good roads where those good roads ought to be placed and how they ought to be paid for, if the farmer is to get a fair share of the benefit of good roads, and I am just a good enough farmer and I believe sufficiently in the justice of the farmer's cause, to believe that he ought to kick unless he does get a fair share of the distribution of the benefits of good roads. Now, the farmer, the judge says, and it is true, had been the man who has moved very slowly in this matter of good roads. Farmers who study and think along these lines must agree that the farmer has been over-conservative in a good many instances, but you men here who have lived out in a new farm country, on a 40 acre farm and have made a living there, raised a family and provided against your old age, know that it is a proposition and you know that when it comes to a matter of high tax, you are going to stop and think several times before you rush into that and you are apt to be pretty conservative when you have spent your life on a farm of that sort, striving to educate your family and provide against the old age that you know is coming on, and when that conservative farmer read that good roads cost from \$2,000 to \$10,000 a mile, he says, "It will take more than my whole farm to build a road in front of my farm; I think I ought to be a little conservative about the matter;" so don't blame the farmer too much if he has been conservative. He has been and is conservative, and it is a mighty good thing that he is conservative, because he has been the balance wheel, in a way, and has kept the men from some other industries from going faster and further than they ought to go. Now, we are all pretty well agreed today that we ought to have better roads, that we have come to a time when we must have better roads, and we have generally come to agree, I think, that the cost of building and maintaining these roads ought to be equitably

distributed between the locality, the State and the nation. The farmers, I think, the great majority of them, are today ready to come and stand with the automobile manufacturer, the automobile user, and say that we will contribute our fair share toward the building of good roads, if those roads, as I said a few moments ago, are to be equitably distributed; but, my friends, you will not blame us farmers of this country if we set back in the breech and set back pretty hard, if you are going to build with the money that we help to contribute, a national highway that is not coming within a hundred or even a thousand miles of our homes or the roads over which we travel. Now, there are a great many different theories in regard to how these roads are to be built and where they are to be built. I say we have come fairly well together in the matter of agreeing how the funds shall be raised. Now, the question before the man who is honestly interested in better roads in this country is to decide fairly where those roads are to be builded. I, as a farmer, and this great national farm organization that I represent, have no objections to boulevards being built across this country. We have no objection to great national highways or old trails or memorial highways or anything of the kind. We have no objection to State highways that shall join the larger cities of the State; in fact, we know there are farmers who live along those highways, and in fact we know that the greatest traffic is upon those highways and we are ready to agree that those highways shall be improved and we are ready to help raise the money to improve those highways, but we believe that at least a fair share of that money ought to be spent to improve the roads from the doors of the farmers who live scattered over this State and other States to the market center of that farmer. Now I don't want to speak to you here from a selfish standpoint this morning. I believe I am justified in saying the things that I have said, that is, the farmer's contention, from the fact that money cannot be spent for better roads, that will improve the condition for a great majority of the people or that the greater majority of the people ought to be interested in any one road than that road that leads from the farmer's door into the market or from one farmer's door to another farmer's door, or to the church door, the school door, or the door of the grange hall and other institutions that enable that farmer to get out and mingle with his fellows. I want to say to you road men as to every other good thinking citizen of this country today, there is no question before the American people that means more to them, that means more to the perpetuity of this great nation of ours than the improvement of the condition of the American farmer, to make the life of the American farmer pleasant and the home of the American farmer more attractive to the great majority of our citizens in this country. There is one question that is bound to come close to us all, and that is the great question of the food supply of our people. A little over thirty years ago, approximately, out of every three

people in the United States, two of those people were upon farms producing the food to feed the three. After thirty years, approximately, out of every three people in the United States, one of them is upon the farm producing the food to feed the three, and the trend of the past decade and the trend today is all away from the farm into the cities. My friends, I just stop and ask you, if something is not done to stop the trend of that movement from the farms into the city, what is going to happen to this nation of ours? What is going to happen to the people of the city? We want a certain number of our people to go from the farms to the cities, because we want cities and we know that we would not have cities that would be worth while for a great many years if we did not send the new blood and the stamina and the gumption and the ginger from the farm home into the city. We need a certain number of those boys to go into the cities, but I want to say to you that the time is here when, for the best interests of this great country of ours, we must keep a part of the brains that is growing up in the country back there in the country, and nothing is of more interest to the dwellers of the city than that we shall be able to keep some of the brains that are growing on the farm out there in the farm home. Just let me give you another illustration along this line. One of the supervisors in one of the best agricultural counties in the State of Michigan, last spring when he passed his assessment took a census to determine the ages of the men doing the farm labor in that township, and what do you suppose was the average age of the men in that agricultural township in an agricultural county in the State of Michigan? The average age of all the men doing the farm work in that township was 55 years. Now let me stop and ask you, if we go on with that and increase the average age of the men who are on the farm, how do you expect to be fed in the cities at all? We must change that. I have always lived upon a farm, I have always been interested in a farm and, like our friend from Missouri, I haven't any money invested in any other industry than that of farming and agriculture. Perhaps I see the farm end of it, but if I see the farm end of it too clearly, I want the man who sees the other end of it more clearly to tell me how the people of this country are to be fed and how this nation is to go on in its national greatness as it has been going on for the last hundred years or more, unless we are able to keep more of these men upon the farm, and I want to say to you, from a study of farm life, that I don't believe there is any one thing more essential for the betterment of the institution of agriculture, I don't believe there is any one thing that will help to make life upon the farm more attractive, I don't believe there is any one thing that will help to hold the men upon the farm and the boys upon the farm, more than to have a good passable highway from that farm home to the city where the young man can get out and see his girl, not six months in the year but twelve months in the

year. Not only where the farmer can get his products to the market when they are cheapest, but where he can get his products to the market for twelve months in the year, not only for the benefit of that farmer, but for the benefit of every other citizen of this great country of ours. So I want to say to you that in this consideration of better roads and where to build those better roads, build your national highways, build your State highways but, my friends, don't forget the man at the other end of the bad road; don't forget that it is not only that man that is interested, but every other citizen of this country that is interested in making that man, in bringing that man closer to his market and closer to his fellows and making life upon the farm more attractive, because it is not only for the interests of the farmer, but it is for the interest of the automobile builder, the automobile driver and every mother's son, every man in this country who is interested in the building up and perpetuity of our great American institutions. Thank you.

THE CHAIRMAN: I have been very much interested in Mr. Hull's statement, and I think possibly if he understands our system in New York, he will appreciate what we have been trying to work out there under our scheme of 12,000 miles of highways in New York State; we are trying to re-arrange our county systems so there will not be any section of New York State outside of the Adirondacks and Catskills that will be further away than five miles from any State or county highway, and then, with the money that we appropriate directly from the State treasury to the towns, we seek to make the towns build the proper connecting links in these five mile breaks so that every man in our State will have a road for twelve months in the year whereby he can, by going a very short distance over our town roads, get wherever he wants to go. We ought to have our national highways that stretch across the country, our State highways that tie up with the national system; our county highways that tie up with the State system, and then we must have our town highways that tie up with both our county and State systems. We are trying and I think will work out a pretty good scheme toward that solution. In our State we have, I think, a unique system. Our local boards of supervisors elect a county superintendent of highways and that county superintendent of highways, elected by the boards of supervisors of each county, has to do, in a way, with our State and county highway construction, because no State road, built in a county, can be or will be accepted by my department unless the county engineer approves of it, and no county highway can be accepted unless the county superintendent and board of supervisors approve of it. I am asked to call upon Colonel Suggs of Oklahoma, which is a great big State and wants national roads and probably needs them.

ADDRESS BY COLONEL SIDNEY SUGGS

State Highway Commissioner of Oklahoma

I have waited long and patiently. I have heard so many discussions on the subject of good roads and better roads that I have really forgotten what I intended to say myself on that subject. I don't have to explain to you people that I am a farmer, my very looks show that.

We were out last night, a number of us, to a show. I was very sorry that we couldn't pull off that show as it was intended by Mr. Warren. We had a good Light at the start, but we lost that Light; he went out to an executive meeting. He discussed some things last night in which I coincided with him. Down in Oklahoma things are different to what they are up here in Michigan, to some extent. We have some good roads down there and we have some very bad roads. We have some old roads—you'd be surprised when I tell you that I have traveled over roads in that State that were built eighty or ninety years ago, laid out, that are good roads today, splendid roads, that will hold a steam engine, not only an automobile or a traction engine, but a steam engine; but there's not enough of them. I don't know, my talk is sort of automatic, self propelling, and I have been crowded so many times that I arranged my speech sort of like a freight train is made up. Whenever the fellow jerks my coat, I just put on the caboose and the story is ended. About the beginning of the good roads business, I find now that I am sort of in the condition I was eighteen years ago at Guthrie. We had a good roads meeting at Guthrie, Oklahoma, and of course I was there; it was the first meeting that was ever held in that State, and do you know that we went and stayed all day and late in the evening? We had our resolutions committee out and we had all of our arrangements made to build the road and we actually went down in our pockets individually and made up money to send two men to California to see how to build these oil sand roads. We heard a good deal about that road they built out there by putting oil on the sand and fixing it up, and we didn't have a right-of-way to build a road on. We sent those men out there. Then, when we got statehood, which was the thing we were all praying for, and this Convention, while it is so much better than any other I ever attended, still reminds me of a trip I had to make to Washington to see Mr. Hitchcock on some very important matters for our country, the Indian country, and there were three of us who went, one from the Chickasaw nation, one from McAllester and one from Ardmore. I was the representative from Ardmore, and whenever Mr. Hitchcock was down there, I armed him around, showed him our magnificent pavements and sidewalks and so on, and thought when I got to Washington, of course he'd be mighty glad to see me, and I don't know, he was glad to see us when we walked

in, treated us just as nice as he could; we went in and he said "Gentlemen, I am very glad indeed to have you come this morning. How can I serve you?" I was all swelling up you know, it was a little out of the ordinary for gentlemen from the Indian Territory to see the secretary of the interior. I told him what our needs were, and then I had a sideline for Ardmore, some little special needs for Ardmore. The other gentleman told him what the general wants were, but he had a little special line for Chickasaw; the other gentleman told him about what we needed in the Indian Territory, but he had a sideline for McAllester. All of us felt like we had done our duty, but do you know what that man did to us? He said, "Gentlemen, I am very glad to have you here, but I would advise you to retire and resume your labors and when you have agreed on what you want come in and I'll hear you. Good morning." I went out and looked at the other fellow and I said, "Did you do that?" He says, "No, you done it." Well, we didn't know how to speak to each other for a few minutes, we were each accusing the other fellow of doing that. He said, "Good morning." We went out and got together and I do hope that this Convention will get together on some proposition that we can carry to Congress. Let us unite on some one proposition and let them know that we are interested in that one thing. Let us agree upon it. I tell you, if you will pass resolutions here like I believe will be adopted by this Convention, I am going to volunteer to see that your action is endorsed in Oklahoma; and I believe I can have it endorsed in Arkansas, as I have to be there on the 14th of this month at the meeting of the State Good Roads Association, and I would like to assist those men from Arkansas in seeing that resolutions that you agree upon here and pass, is passed in Arkansas.

A DELEGATE: I will take it to Indiana.

COLONEL SUGGS: All right, well, who is next? Let every man go home with the determination to see that those resolutions are adopted in his state and we will make it so warm for those fellows that they will hear us.

A DELEGATE: We will adopt them tomorrow.

COLONEL SUGGS: Good. On this road business, I am liable to talk to you largely about Oklahoma, and I don't want to appear like the fellow did that was making a speech in the city and the old man couldn't go to hear it, but had a negro that could repeat any speech he ever heard and he sent him to hear the speech and repeat it to him. The negro went to the meeting and came back and he said, "Jim, what did that man say?" Jim said, "Boss, he made a powerful speech." "Well, what was it about?" "Well, sir, the most of it was about a recommending of hisself." Now,

I don't want to be here recommending myself. But, when our constitutional convention met in Oklahoma, there was two or three of us there—I wasn't alone, and we decided that we ought to take time by the forelock and have a department of highways created during the sitting of the constitutional convention, and after working there for weeks with that convention, we finally got the good roads committee appointed, a committee on good roads, to frame some road law. We got before them and it was a very short article, just brief, but it said this: "the legislature is hereby directed to create a department of highways." Now, we worked on that word "directed." We wanted to get something there that they could not slip over. We didn't say, "they may;" but we said, "they are hereby directed;" and so it was written in the constitution in that manner. The first legislature failed to notice it. The second legislature failed and for sixty days we worked with the third legislature and we got that law vitalized by one vote and had to ask a man to change his vote in order to get that, before it was announced. Then the fourth legislature came on. The third legislature vitalized it and I was appointed the State commissioner of highways. I was about the proudest fellow you ever saw, and I just knew that the fourth legislature was going to do all that I asked. I made a report showing where we had spent \$4,000,000 in the State, showing what county it had been spent in, showing the levees, showing all those things, but I couldn't tell where it went; there was no record kept of the amount of bridges they had built or the lengths of them, the amount of culverts, etc., but the \$4,000,000 had been spent. I showed it there to them, and I just felt that when the legislature met I could just walk in there and say, "Now boys, we have squandered about \$10,000,000 on roads and bridges and there is no county that can give me any definite idea as to any definite amount they have spent or the length of the bridges or even the contract price; now then, I would like for you to pass this law"—I had the law already prepared myself; I never dreamed of any opposition. Why, you know how a fellow will get that way, have it all fixed up in his own mind and think everybody agrees with him. I never made a bigger mistake in my life. When I went to that legislature, do you know what they said? They just spent sixty days and abolished the department of highways and Sydney Suggs every morning for sixty mornings. Why I was told that one morning—I wasn't there—that the Chaplain said "Oh, Lord, give us this day our daily bill to abolish Sydney Suggs and the department of highways." Abolishing the office, abolished the department; they said, "We've got no use for you." That did away with 3300 township trustees. I was trying to make the county the unit. Let the county build the roads and make the county the unit, and the way it was down there, every township was a unit and those three commissioners bought the culverts and bought the toy tools, the wrinkled tin and toy tools and bridges up to 12 feet, and 3300 of them buying those things, I never

thought about all those fellows having friends in the picnic eager to get some of this money. The trouble is here, it is here for you and they are keeping a lobby right down here, the wrinkled tin, the brokers bridge, and why I call it a brokers bridge is because it is a bridge that is made to sell, it is not made to carry a load. That's the way those bridges were—and the toy tools. Send them out there, and there were 3300 purchasers and they were buying them with the people's money. Why, in my own township, they spent \$53,000 there building roads. I live in the same township the governor does. I said they spent it in building roads—I got that wrong. A man always gets wrong though when he says they spent that much money there—but we never could see where it went. There was one of our commissioners that built a road leading north and he had five bridges in a mile and a half. There was a little creek that ran down between two hollows and he followed that down, when, if he went over 150 feet, he could have got through and put his road on a firm foundation. Now, Ladies and Gentlemen, there is something to this road business that has not been discussed here; there is more to it, it seems to me. I have some idea about the results of the road business. There's a lot of evils in this country that we have got to stop, and I believe that in order to stop them effectually, we have got to reduce the cause. How are we going to do it? You can send up here to Mr. Page and for 5 cents he will send you the amount of freight you can haul over a mile of road, over a bad road, over a good road and a bad road, the difference in the hauling of a load of freight over a good road and a bad road. He has got that figured down, got the time figured down, the saving of the horses figured down, got the saving of the harness figured down and the saving of the wagon; that's all in figures, and you can have it for the asking. But, my friends, I contend that there isn't paper nor pencils enough in this United States to figure out the saving of our boys and girls that are coming to the city on account of the bad conditions in the country. The cities have been robbing the country of the best brains for a number of years—fifty years, possibly. I tell you it is deplorable. I have been to one or two of your cities in the east and I have heard the gentlemen there talk about it. I am not using my own experience, but just what I see and what they tell me. The young man that makes \$15 a month on the farm saves up \$100 or \$150 and concludes that he has made about enough to go to the city. They tell him, "There you can get \$15 a week, four times as much as you can get in the country." I tell you that's a dazzling offer to a young man and he studies it out, figures it up and decides he can do better in the city and he goes, he leaves the farm; he leaves the things that he is acquainted with and knows how to manage; he goes to the city; it even happens in as small a place as Oklahoma City, which has only about 62,000 people. I have seen them come there, boys from home, I knew their parents; they didn't realize when they got there that there were hundreds

of parasites and leeches that just live on his sort. The only way they can get any money is catching the greenhorn from the country and they pick him till he is clean. In three months time that boy has resorted to things that he is ashamed to tell his mother. It don't only apply to the boys, but it applies to our girls. One in twenty will succeed. It is like the old '49ers; some of you gentlemen remember about that, hearing about it and a number of you remember about the Klondike. Those that went to the Klondike and those that went to hunt gold in California; those that succeeded, their names were written at the top of the page, but who ever recorded the thousands that fell by the wayside? And that's the way we are going. It is an abnormal state of affairs, and how are we going to remedy it? How are we going to remove the cause? What method have we got? Take a young man to the city and he learns the art of working in machinery as they are doing right here in this city, and I want to say to you that as long as he is able and as long as his sight is good and his nerves are steady so that he can turn that journal to the thousandth part of an inch that is required in that institution to make that machine perfect, he can work there, but after he has worn out a dozen machines that cost that company \$1000 a piece probably and seen them dumped over into the scrap pile, he knows that when he gets in that condition that his eyes are dim and his hands a little nervous so that he cannot do that work, he will be dumped over with just as little ceremony as that machine was dumped over. I want to say to you that we have got to build those roads, we have got to build them in some manner; the way to do it is what we are here to discuss, the best method; the result is what we want. My contention is a good deal like that of Judge Lowe, that the quickest way, the best way and the only way that we are going to get the results that we so much desire is to let the government build its roads and then maintain them as government roads. Then I believe the States will have pride enough to build lateral roads into these government roads and in my State I will guarantee that the counties will have pride enough to build laterals into those government roads, and in my State I will guarantee that the county will have pride enough to build laterals into the State roads. And then I will go on down to the grass roots and I will see that the townships build laterals into the county roads. I will go to every school-house and go all over that county, and I know the nature of those people, but I tell you, when we get to talking about good roads down there, there's some member of the legislature will get up and want to amend the bill. I told one of them—the man is in Congress now—I says, "You are afraid to fight that bill in the open, you are ashamed to do it and you know that your constituents will turn you down, but you amend it, put on enough amendments to kill it, and here you are talking about building a lateral road into your town without having a trunk line. They don't build laterals first, they build trunk lines first;" and I think this subject is of so

much moment that I wish I could elevate my voice sufficiently to be heard in the halls of Congress. The government has got to set the example and then the States will follow, but unless there is enough earnestness displayed here to let those men know that we are in earnest about it, I am afraid they will pass it up, I am afraid they won't hear us; but I wish they could hear us and know. You think about what the government can do. In that western country they have given thousands and thousands of acres to railroads to open up that country; the railroad company has made money out of it. Why shouldn't they help to build the mains that feed those arteries in the very same kind of a way, in the same manner? Look at what they have given to the rivers and harbors. Why, they are even appropriating money for air ships. That is all right, but let's get the roads first. I want to see the time come, and I tell you it is approaching in our country—we've got the railroads down there a number of them, and are building more, and the world is our market. We have got land there—I attended the Kansas City Land Show a year or two ago, where they were selling lands in Utah, Colorado, Oregon and California at \$500 an acre, and I want to say to you that we have got thousands upon thousands of acres in Oklahoma that is just as valuable as any of those lands, we've got innumerable streams, living canals that, with their own power, will irrigate those lands, but we must have roads to get the products of those lands to the market, and I made this proposition to towns down there, I made it to my own town, I said "If you will build these roads in here and sell this land in small quantities to the man that wants to till the soil—and I say it ought to be made possible for every man who actually tills the soil, for him to have an opportunity to buy that soil and own that soil that he is tilling, I don't mean to give it to him, I mean he ought to own it, to become a home-loving patriotic citizen as he would be if he owned it, even though it was only 20 acres, if it was his land—you can't get much patriotism out of boarding houses, a man won't fight for a boarding house but men will fight for their homes—I, at my age, and I am not so very old, can take 5 acres of ground, 10 miles from town, and if we had a road out there so that a gasoline wagon could come out every morning and take every bunch of shallots and lettuce and tomatoes and okra and asparagus and eggs and butter that is raised there on that 5 acres to the market, I will make an independent living. That's the last country we are going to open up, and I told those people down there that we must get together and keep our young people at home. They can't go into new countries and get lands as some of us have got them down there. There are no more new countries to be opened up. Let us make it possible for them to stay here, make it possible for them to get their homes here. We cannot do it if we go on as we are. You know that the greatest intelligence of this country, you will find it by going right here in your own city, you will find that the best brains are invading farm

machinery, making farm machinery to cultivate the land, and they are making machinery to harvest the crops, and what does that mean if we don't build these roads? If we don't get together and build these roads, in fifty years some of our country will be a country of landlords and tenants. We have got to build the roads in order to avoid that. One man will control 10,000 acres, and what will the others be around there? They will be hirelings and they will be tenants, won't they? Is not that the history of other countries? And to think about our State, where we raised enough last year in our gardens, on our vines and trees, to pay the taxes of the State, that rotted on the vines because we couldn't get it to the market. It's a serious proposition and I hope that before this convention adjourns—I don't care, I've come a long way, if I had to stay a week longer in order to get results, I'd stay. Twelve years before Statehood, I built my own school house, I sawed the lumber with my own mill, I hauled it out of the woods with my own ox team and in many instances, I drove the oxen myself—I'm not telling you that to make you think I've done anything great, I had to do it, and I built my own house and built my own benches and hired the teacher to teach my five children, and I built 20 extra seats that I rented to him for \$1 a month, I gave him \$10 a month and those seats and his board and lodging, and he rented the others. I then went, when I saw what was going on in that country, I went to Little Rock, I started on a tour, I went over there and told these men I thought I'd put it in a commercial way, I was the president of our Commercial Trust, and went in a commercial way and told them what we had. I told them that I hailed from the biggest inland cotton market on earth, and it was at that time, as high as 50,000 bales of cotton was hauled into that town of Ardmore annually and sold off of the wagons by the men that raised it. They said "What else have you got?" I said, "We have got the finest wheat on the globe growing in the valley of the Wachitaw and the Indian Territory." They asked, "What else have you got?" I said, "We have got the finest cattle country under the sun; we take the premium at St. Joe, Chicago and Kansas City for the best short horned cattle." "What else have you got?" I said "We have got 100,000 bright eyed boys and girls who are sons and daughters of pioneers, and 10,000 of those are growing over age every year and our jails are filling up with those boys and it is for them that I have come to plead." Now the government is sending boatloads of teachers to the Philippine Islands to teach those people and the very best people of America here need some help, and at Little Rock they passed a resolution and notified their Congressman to help us out. I went to Memphis and met five different organizations with the same result. I went to St. Louis and Kansas City on that same mission and men stood around and said, "I wonder where Suggs is getting his graft?" I said, "I got it last spring, I got it all back, and I got all the money, all the interest and

compound interest when I was called upon to address 250 bright eyed boys and girls in the City of Ardmore when they marched in and took their seats in a \$100,000 school building; there wasn't a man in Oklahoma happier than I was. I told these boys and girls that when they got through with their education, they didn't have to leave Oklahoma for a better State, for in Oklahoma the grass grows greener, the sun shines brighter and the birds sing sweeter than anywhere else and we have got the best boys and the sweetest girls on earth, and when you get tired of this country, come to Oklahoma and help me out in building good roads.

October 2, 2 p.m.

HON. J. N. CARLISLE, Chairman

THE CHAIRMAN: Gentlemen, the discussion that is going to take place this afternoon is one that is very interesting, particularly to commissioners in charge of State roads. It is a particularly interesting subject to me, because, under the New York State law, they provided last winter that the State commissioner of highways could make reasonable rules and regulations covering the traffic on State and county highways. We have not made any regulations in New York State yet, because the problems were such that we thought we ought not to be too hasty in taking them up, and I am particularly anxious, myself, to hear what you gentlemen have got to say in regard to the use of State and county highways as affected by heavy truck traffic, and Colonel Sohier, of Massachusetts, who has taken great interest in the subject, will first speak to us on that proposition.

ADDRESS BY COL. WM. D. SOHIER

Chairman Massachusetts Highway Commission

I am sorry there are not more of the highway commissioners here, because I have been having very voluminous correspondence with the commissioners of various States in the Union, who wanted to know what regulation they ought to have for their roads, and we have had much more correspondence in Massachusetts from the towns that have said, "What are we going to do for our roads which cost us \$2,000 or \$3,000 a mile to build, gravel roads, when one man in town buys a truck and runs over that road in wet weather and ruins a road we have been ten years building?" One little town in Massachusetts had five wooden culverts broken in one day by one lumber truck that carried 10 tons, and it cost \$3 on the tax rate to put them back, and a week later that same truck went over a covered bridge and broke that down and it was closed so that everybody had to make a detour for nine months. One

of these six ton trucks, weighing 13 tons probably with a load, went through and broke the bridge between Ayer and Shirley and sent everybody else around for the next year and a half until the county and towns got together and built a new bridge, and they wanted to know what they could do. In the city of Boston, Mr. Sullivan, the road commissioner, saw them getting ready to move some very heavy object, I have forgotten what; he knew the bridge was insufficient, so he told them they must not go over that draw bridge and told the draw tenders not to let them, and they waited until one rainy night and got part of the way over, broke down and got stuck and then he tried to sue them for damages and found there was no law under which he could collect; consequently, about a year and a half ago, I began to study a little on road regulations, because I believe that, contrary to what I saw in the papers in Boston, which said that we must build the road to carry the traffic as the railroads did, I wonder what they would think of a railroad that had bridges that would carry 56-ton locomotives and bought a lot of 100-ton locomotives and broke all the bridges down before they got bridges strong enough to carry them. You have got your roads, and if you do not regulate the traffic, you won't have your roads and won't have the traffic either, because they cannot go over it; and I found that England and France, Belgium and Germany had adopted regulations for various kinds of traffic. They had a regulation—the English and French regulations were very nearly alike but the English was a little more liberal than the French. If I remember rightly, they had a regulation by which nobody could move anything over a road that had more than 800 pounds per inch width resting on the road surface, and we adopted that in Massachusetts and it doesn't make any difference—excuse me a second, we adopted that in Massachusetts for roads that were not pavements, it does not apply on the city pavements; I think it ought to and soon will, it makes no difference whether you use a wheel or board, without a permit you cannot move anything over the road that has got more than 800 pounds per inch width, which is very nearly the steam roller specification; it is just about where the English traction engine goes. We have got into our law a provision that no motor truck weighing more than 4 tons with the load could go more than 14 miles an hour, and no motor vehicle weighing more than 6 tons, including the load, could go more than 6 miles an hour on iron tires and 12 miles an hour on rubber tires, and we have recently notified several of the sightseeing omnibuses that if they exceeded that speed limit on some of our narrow roads, we would take the licence of the man away and take the registration of the car away and he could not run on that road. We have got in our law a provision that nobody could pull anything over the road with any flange or rib that substantially injures the surface of the road to any considerable depth. We said that nobody could move more than 14 tons over the road without a permit. Nobody

can move more than 12 tons over the country roads without a permit. Nobody can collect by law now in going over bridges if they are posted, in Massachusetts, if they move over 6 tons. The authorities are authorized to grant permits and to specify in those permits the particular routes to be taken or any other precaution they desire to take; that the authority in charge of the road, whoever it happens to be, with us, the highway commissioner on one road, the county commissioner on another, some street department or road commissioner in villages—

A DELEGATE: The 14 tons would be on one truck?

COL. SOHIER: On one load.

A DELEGATE: Could they draw a trailer?

COL. SOHIER: Yes, sir. We put another thing in that law, that anybody that violates the provisions of this law, driver, owner, or operator, who violates the terms of the permit, shall pay all the damages and the damages shall be collected and paid into the fund of the person that has to repair that road. We had a fine, of course, but that depends on the police force and the police force will not necessarily prosecute; I don't think we shall, but it gives us a chance to do it. Any local authority is authorized to limit the speed of those vehicles weighing over 4 tons with the load, to 6 miles an hour, over any bridge, provided he posts a notice conspicuously at each end of the bridge. I have often wondered—I would like to hear some one talk about it. I have always wanted time to sit down and figure what the man got out of the road and who ought to pay for it. It is pretty evident to me, or seems to be, that no one individual in the community, merely because he can make a living or even employ a workman profitably, should be allowed to tax the community more than he gets in profit—we'll put it that way if you like. He should not cost the community more than he gets in profit, because if we have to pay more in taxes to maintain a road in order to allow somebody to do a lumber business with a truck over it then he can make in a year, it is easier for the community to put him in the poor house and support him there, because it is cheaper. When the automobiles were turned over on one of our very good gravel roads between Albany and Pittsfield, main through line, it meant 700 cars a day going very fast over this little gravel road, that this little town had borrowed money and built in ten years, with our assistance and in three years it didn't look like a road. It was holes and ruts and mud holes. It was a very good gravel road before that, as good as you can build, but it would not stand 700 motor vehicles going over that road, and those people ploughed it up; they said "If we can't use it, you sha'n't, because our bonds ain't paid yet;" and we told

them to fix it up and we would help them with it next year and we did; we are allowed to put 20 per cent of our vehicle fees, which amount to \$20,000 a year, into improving roads that way and we help them put that road back in good order, and I think they could go over it this year and not do any damage; it is coated with oil and Tarvia. I hesitated at one of my other talks when I saw so many gentlemen from various States where they do not and are not dealing with the problems of heavy traffic as we are in Massachusetts, to discourage them by giving maintenance costs, but it happens to come a little bit in line with what I have been talking about on truck regulations, and so I am going to tell you a little something about England where they keep much better accounts than we do of what the cost, as far as they can tell, of motor bus traffic is. Now an English motor bus is, I should think, just about the equivalent of any one of our $3\frac{1}{2}$ or 4 ton trucks. It is a double decker; it carries 16 people inside and 27 outside, if I remember rightly. They have five minute service to a great many places from 15 to 25 miles out of London. I don't happen to remember any further out than Hampton Court. They have been recently established, many of them, and as you probably all know, the motor bus traffic in London, if you haven't looked at it two or three abreast and you wonder where the taxi is going through, but when you stop on the end of the main street crossing, you will see ten buses in length and two or three in width awaiting until they get the signal to go across. They were proposing a speed limit at Hyde Park when I was in London, and the traffic captain went before the authorities and said, "We cannot move our traffic if you give us any speed limit; we have got to have the foot passengers and traffic going so they won't interfere with each other, and the traffic cannot get through if they don't go fast, because 10,000 vehicles an hour pass Hyde Park corner and they will back up for 2 miles if we only let them go 2 miles an hour; they go 20 miles an hour when they get to the middle of the street and never let anybody cut in, walking or driving or any other way." In Middlesex County you will find in the *Light, Railway and Tramway Journal* for August 8, the damage done to roads by mechanically propelled vehicles, weight about 6 tons, motor buses—I think the 6 tons would include the vehicle and load—Mr. Wakeham, who is the county engineer, gave the average cost of 16 roads running in and out of London in Middlesex County, main traffic roads, before and after the establishment of the motor bus traffic. His roads had cost him $12\frac{1}{3}$ cents a square yard a year to maintain as water bound macadam roads— $12\frac{1}{3}$ cents a square yard a year, before the advent of the motor bus. When the motor bus came in, it cost him 25.6 cents per square yard per year to maintain his roads. He gives the whole table there and the variation in cost was between 4.5 and 20 cents before the motor bus, and after the motor bus, between 14 and 42 cents; and one curious thing was that one of his roads, which cost

16 cents before the motor bus, suddenly jumped to 42 cents after the motor bus. His charge in 1911 and 1912 was 1.2 cents per ton, per mile going over that road, and in 1911, 1.8; in other words, it increased because of the motor bus traffic. In his opinion, that is all the traffic showed it to have increased, but the cost of transporting one ton or keeping the road up had increased 0.6 cents or 50 per cent increase for every ton that was hauled over that road, and the increased cost from the motor bus traffic was 4 cents a car mile. Under the special act of Parliament, they taxed them three-quarters of a cent, and the *Light, Railway Journal* was publishing the editorial to show that the motor buses should be charged somewhere near in proportion to the damage they did to the roads, if they were to establish their lines, which again comes back to how much should the community pay, how much more than the 5 cents of that company, if it is going to cost the community 3.25 cents a mile every time that vehicle runs over the road, and I think you will find it costs usually very nearly 1 cent a mile per vehicle to maintain a macadam road. You do it somewhat cheaper with oil. I think that's all I want to say, Mr. Chairman. If any gentlemen will write to us and wants, at any rate a start at a motor vehicle regulation law for motor trucks, etc., and will write to our secretary in Boston, we would be very glad to send them copies of the law that was as good as we knew how to draft at that time. We have got a wide tire law applicable to all vehicles, that was adopted without any opposition whatever from the farmer, but the title of that law was "An act to regulate motor trucks and other things going over the highway," and we did not advertise whether it was a motor truck or an iron tired vehicle drawn by a farm horse, and we got it through without any opposition, and if we are reasonable in enforcing it and gradually jack them up and not make them all do it all at once, I don't think we will have any trouble with the farmers and we will have our wide tire law. There is a penalty of \$100 for each offence.

A DELEGATE: For only using or selling?

COL. SOHIER: A fine of not more than \$100; but for any vehicle that damages or breaks the bridges, if the man is violating the 6-ton law, he has got to pay for the bridge and it cost \$3500 to repair or rather to rebuild a bridge that was broken by one truck between Ayer and Shirley, it took all summer and cost \$3500, but in the Richmond case where I said it was \$3 on the tax rate, the valuation is only \$100,000 in that town. The bridge cost \$1500 to put back; and we have got a great many bridges in my state that are not designed and were never meant to carry anything over 6 tons. We cannot move a steam roller over them and do not do so without strengthening them, but a fellow comes along with a 6-ton truck and a 7-ton load, going 20 miles an hour, and you know what will happen.

A DELEGATE: Is that a local law?

COL. SOHIER: This is a State law, for the State of Massachusetts, applicable everywhere.

A DELEGATE: It could be made a local law?

COL. SOHIER: It is a local law authorizing people to make a 6-mile speed with a vehicle weighing over 4 tons, and we have authority locally to post the bridges down to 3 tons, if the bridge is unsafe, and before this law went through, the man could not recover any damages, but neither could we. Now, if he takes ten tons over one of those bridges and breaks the bridge, he will have to rebuild the bridge instead of you; that is the difference.

THE CHAIRMAN: I am very much interested in that to show how the different traffic laws in this country compare with what they have in other countries. In New York alone the automobile licenses there run to 126,000 in number, of which 35,000 are trucks, while in the whole of France, the entire number of vehicles only amounted to 84,000 and in Germany very little over 60,000. In the State of New York alone we are carrying a great deal heavier traffic in number of vehicles and everything else than they are doing in France and Germany, nearly combined together. I will call upon Mr. Ricker, of New York, our deputy commissioner of highways, because he has given this matter a good deal of study in this State. Under our State law, there is now a provision that no truck company or sight seeing cars or any trucking for profit outside of private business can go into existence without procuring a certificate from the public service commission of New York, putting them in the same category as any other transportation company. There is a large number of applications for permits in our State and we are now considering the terms upon which those permits shall be granted. I have the pleasure of presenting Mr. George A. Ricker, first deputy commissioner of New York.

ADDRESS BY GEORGE A. RICKER

First Deputy Commissioner of New York

As Commissioner Carlisle has said to you, we have the problem of what to do to protect the property, the roads in New York State, from the unusual, perhaps we might say the cruel and unusual punishment that will be given them by the motor trucks. In the densely populated section of the eastern part of the State, the motor truck is very prevalent. Even where electric railroads are operated, in the roads or beside the roads, the motor trucks are running ap-

parently with profit because they continue to run and multiply in numbers, even in competition with electric railway service. Now, these cars weigh all the way from 5 to 15 tons, and they run at considerable speed. The public service commission is hearing applicants who desire permission from them, as they are now classified as common carriers, to operate over our highways. As a rule these cars—you are familiar with them—run on four wheels; they have hard tires and they run frequently and at considerable speed. I have participated with members of the public service commission at these hearings and have brought out the facts regarding weights, sizes of wheels, loads, speeds for the purpose of selecting data that will enable the commissioner to make rules for the protection of the road. These lines are increasing with such rapidity that it is a very serious problem with us and a very pressing problem. It is not one that we have got to think about for the future; it is with us now, and we are anxiously looking for information from all sources as to the limitations that we shall put upon these cars, as to the loads that they may carry, as to the size of wheels, width of tire and speed. It is no unusual thing to see cars running at a speed of 25 miles an hour with heavy loads, people hanging on the running board, and on one of the hearings, I know an Italian who ran the car and when asked what he did when the seats were all full, he said "We sat them on top." Now, that is a pretty serious problem. In addition to passengers, they carry heavy loads. Of course the difficulty Colonel Sohier has spoken of with regard to bridges is also very serious. Now, we cannot exclude those people from the road; they apparently have the same rights any other citizen has to use the roads, and the people in the localities in which the lines operate want the buses, they are a great convenience. They patronize them liberally, and these buses run all the year around, too, though naturally in the winter time they are not as popular as at other times. A point that has arisen in these hearings is on the amount of money that they shall pay, if any, towards the upkeep or the cost of construction. Where our electric lines run on improved highways, they are required to pay, as all railroads have to with us, for the pavement between their rails and 2 feet outside. Now, the law says that these buses, these bus lines, may be required to reimburse the railways for some portion of that expense which the railroads have already contributed to the pavement. Now, that is a very vexing question. Most of the applicants who wish to run these buses have about enough money to buy a bus and a little left over for a few trips for gasoline; when that is exhausted, then they depend upon their daily receipts. If they are to be saddled with any part of the expense of the pavement, it shuts them out. I am hoping that the public service commission may do something of that sort. I noticed in the car before I came up a paper entitled "What the Automobile has done for Good Roads." I think somebody ought to write a paper on "What the

Automobile is doing to Good Roads," especially the automobile truck. That there is need for more durable types of pavements, of course we all know very well, but how in the world to meet the unreasonable use of the roads that is brought about by these heavy trucks, is the problem that we are studying, and this problem has come up so suddenly that we hardly know where we are at. Any thoughts that any of you gentlemen have growing out of your experience with them, will be very gratefully received.

THE CHAIRMAN: We will be glad to hear from any of you gentlemen in relation to this matter. The matter is now open for discussion.

MR. WASHINGTON: It may interest you and other gentlemen here to know that this question is such an important one, that I find that abroad it has been given attention for more than a century, and I found the other day, in looking over the road history of some European countries, traffic regulations as to the weight of vehicles, the loads they might carry and the width of tires, made in 1809, and as far as I can gather, there were some regulations even previous to that period, so we can see this is a question where, in older countries, they were at the point we are at now and realized the importance more than a century ago of regulating tires and saving the roads from undue wear and unnecessarily heavy loads, greater than they should bear, and in nearly all the prominent countries of Europe, they have drastic and severe traffic regulations limiting the weight, as Colonel Sohier said, per wheel and per inch of tire, and in other words sub-dividing it, in some cases, on the unit basis of width of tire, but limiting the load on a given vehicle. Most of the vehicles in France and Italy are two wheeled vehicles; you hardly ever see a four wheeled vehicle except as a victoria or automobile, all the heavy hauling is done in carts. I have seen a cart of six horses harnessed tandem and I have seen in Paris one with eight horses to it hauling probably ten tons of stone. Sometimes the beds are 12 to 18 feet long, and they pile up casks and building stone on them, and in the ports like Genoa, enormous loads of foreign products of all kinds, and of course very frequently to meet those conditions in the cities they have stone trucks and run those vehicles upon cobble stone blocks 18 or 24 inches in diameter and sometimes 12 inches thick when they are put down, and I have seen cases where they seemed to have been worn down 4 inches and they took them up and turned them. That is possible in European cities where they use their horses tandem, but if you had them harnessed as we harness them, abreast, the horse would be on the smooth or slippery part of the street, not out on the track, and he could not get power enough to pull his load. This is only a trifling contribution, but it may be interesting.

DR. CLUCK (of Pennsylvania): Has it never occurred to any of these gentlemen present that possibly our regulations and licences are not in accord with the road? We in our section have quite a number of motor trucks operating in different vocations. Just the other day I had occasion to pass one, and after inquiring as to the load it carried, I was told it carried 12 tons. We all know that no public highway has been built or is even being built now that will stand such a traffic as that, but as the gentleman has said, large traffic has become a habit, but are these motor trucks, automobiles and all these new fandangoes paying the share of the revenue they should pay for the use of the highway? You take an automobile, and we have heard a great deal about them during this week, the gradation, in my judgment, is not in comparison to the amount of damage to the roads they use. If a light buggy was placed on a macadam road, such as I saw in this city today, it would run for a thousand years and the road would still be there. They told me that road I saw today was put there a year ago, and it is a total ruin. There must have been something to do that, and something more than the ordinary travel these roads were originally built for. That road, I was told, cost the people of this county here about \$17,000 per mile. That is an enormous amount of money to spend on one mile or so of road and have it destroyed in one year. My opinion is this, that license laws as fixed by all the States as far as I have read, graduate by horse power; they say for a certain number of horse power you shall pay \$10, over and above that, \$15 or \$20, and they go on up to a certain standard. This last act I have not read and do not know what it is, but I believe the system is wrong; I think the system ought to be based on the size of the tire, starting with possibly the smallest rubber tire that is used on either steam or gasoline vehicles; it should start with a fixed price, possibly \$10, and graduate for every half inch of tire space instead of horse power, fixing your price so that, while you are not going to drive the business away from you, gentlemen, that's not the idea, but they ought to pay in comparison to what they destroy. No man runs an automobile or truck for fun; no man displaces his horse for fun, he does it for gain, that is every man's object in life, the gain he gets from it, and that is the reason he runs it. The driver of the pleasure automobile drives that automobile because he can afford to drive it, or else he would not drive it. The ordinary business man drives an automobile because he can make more money that way than by going in steam cars or by horse. My idea is this; place a graduated scale of licenses to the inch or half inch or even the quarter inch bearing surface, and then the next remedy I would suggest is this; instead of the funds being paid into the State treasury as they are, they should come back to every county and local municipality where the licence was originally paid from, so that if a bridge breaks down in a township where the

public is already taxed, that comes back, in addition to the fine that the gentleman has well said should be imposed.

MR. SMITH (of New Jersey): Wouldn't it be a better plan instead of taking the measure as the gentleman mentioned, of the width of the tire for the license tax, wouldn't it be better to take the combined weight and speed of the car, because those are the ingredients that do the harm, while the width of the tire does not determine anything. For instance, if you take the size of tire, a Ford car would pay a great deal less than a Cadillac car, which carries a 5-inch tire while the tire of the Ford car is very small and very narrow. I think the three things combined, the size of tire and weight and speed are the three things that should be put together and made a composite from which we should draw the figures, and I think the license should be a federal license and returned to the counties or States in proportion to the number of roads they have in that county; they would be paid right back to the State and the State in turn would pay the money to the counties and that would be an inducement to the counties to have more roads. I believe our association, the A. A. A., are working for a federal licence law.

MR. WRIGHT (of New York): I believe that in New York any person with a load of over 8 tons takes his chances on crossing a bridge, but no public official cares to take advantage of that law. Everybody feels that the bridge ought to be able to carry any reasonable load, whether the vehicle is an automobile truck or anything else of that sort.

THE CHAIRMAN: If there is no further discussion, Mr. Smith of New Jersey wants to speak on the subject of National Roads.

NATIONAL ROADS

BY F. F. SMITH

This matter of the Quebec-Miami highway was to have come up last Monday, but there has been such a crowd of other matters and papers that we had to give way. I am sorry we haven't got a larger number here today, because I feel that this is a subject that maybe some of you don't know about and will be very much interested in when you do know about it. The Quebec-Miami highway is something that is known to very few people except in the East, and I doubt whether some of the Western people have even heard of it. It occasionally crops out in the papers but nobody knows just what it means. For the first year after the formation of this commission which created the Quebec-Miami idea, it was a joke, almost, to think that there could be a road running from the upper end of our States

to the south; practically it is an international road, taking in part of Canada, and is partly governed by a board of governors who are Canadians, and it runs down through the Eastern States and the District of Columbia to Florida as well as through a considerable section of Canada, and consequently it is practically an international road. It was created in this way. Nearly four years ago the New York *Herald* and several other papers got busy and tried to start a road in the South, partly as an advertisement of the New York *Herald* and an Atlanta paper, and they formed a little committee and called it the National Highway. It started from New York and went out through New Jersey and Pennsylvania to Gettysburg and through the mountains of Virginia and was later on continued to Jacksonville, but it is a road that is practically on paper, because it was never found feasible. The Glidden tour went over it, but it had a terrible time. It is rather an impracticable route, because it goes through the mountains of Pennsylvania and Virginia and then on through a wild region where there are no hotels and where tourists have no means of taking care of themselves on the route. The southern part of this road was part of the capital highway from Richmond down and it was a Richmond road. The latter part was never graded and is practically a hog wallow although fenced in and called a road. Three years ago some of us got together and said, "There ought to be a road from the north to the south, because it is needed." We got a committee together and went over the route and picked out a route we thought might be good. At the meeting in Richmond two years ago we formed a definite commission of 30; five Canadians were present there, embracing those gentlemen who spoke this morning, and there were two representatives from each of the ten States through which the road passed and two from the District of Columbia. We dignified ourselves by the name of the Quebec-Miami Highway Association and said we would work without any pay and bear our own expenses for two years. I happen to be a retired manufacturer and have plenty of time. We could not, of course, build the road; we merely compiled the road, just as you'd go to your library and pick out a book and read an author on one particular subject. We got together in three or four different meetings and formed committees from different sections of the country. I have been over the whole route. During May and April I drove up from Miami to Philadelphia, and then in the summer up to Montreal. Josh Billings our great American humorist once said that the hen is a wise bird because she never cackles until after the egg happens. We don't cackle about this thing but the road is nearly done and it is a surprise to ourselves as well as to others that we have been able to accomplish what we have. They say the secret of John Wanamaker's success is not in doing things himself but in making the other fellow do it. We made up our minds to find the missing links and persuade the county officials to do the work we wanted done to connect the route up, and we succeeded. We have

not spent a great deal of money and have not gone into debt. We found out there were a series of roads, for instance, a little piece of road from Montreal to Quebec is not finished and will not be before next year, but from Montreal down there was a continuous highway, the old stage route following the Hudson River. As we got down to New York, we struck another road built one hundred and fifty years ago from Boston to Baltimore, and we used a portion of that. Further down we found short post roads that had been established, some of them one hundred and fifty years ago, so we tried out the different ones until we got some that were pretty good and persuaded the counties to put in the little connections, and now we have a continuous road, although it is not quite finished. The hen has cackled a little early perhaps, but this is going to be a road that will be very popular and useful for different purposes. It is a very scenic road, as you follow it from the Adirondacks down the Hudson, all the way down to New York, then it crosses the Hudson and goes through the Oranges of New Jersey into Pennsylvania down to the upper Chesapeake and takes in a historic route from Richmond to Washington. There are twenty-seven battle grounds on the route within a hundred miles. Further down it goes through the pine regions, Pinehurst and several other resorts used by our people in the winter, and at the same time it connects all these capitals, Richmond, Savannah, Augusta and there are twelve large cities on the route and over fifty good sized towns and dozens of small villages. It goes through a thickly populated region, and geographically it is right. If we went as far back in the mountains as the red line shows, we would find that we got snow in November and as late as April; if we go near the coast, we would find that in the whole route there isn't a hill 100 feet high and there is not a grade over 5 per cent, and there is a good hotel every 50 miles. It will bring the Southern people in the summer to the mountains and lakes and connect all those principal cities and result in a great mercantile traffic. Starting here we have the line finished from Montreal to Washington, with the exception of 10 miles that will be done this fall, practically nearly all a stone road, a little in New Jersey that takes in gravel roads and a little piece farther down that takes in cement roads, but practically it is a stone road. Further down, it takes up the gravel roads through Virginia, and further the sand clay roads. When it strikes Pinehurst, there are 1500 miles of side roads all through the mountains that Mr. Tufts and his associates have built, pleasure drives. In Georgia we strike magnificent roads, hundreds of miles of them continuously. Once in a while we strike a little gap. We have had several very difficult places to overcome. One was a little place in Maryland, only 10 miles had been washed away, built one hundred and fifty years ago, washed sixty years ago and never rebuilt, and finally we tore it all out and put in a new road and it's a sunk-way now; we have just put in a real good cement road costing \$80,000 for 60 miles of it. Further down we had another difficult place in North Carolina where

the log camps shut out the automobiles and wouldn't let us come through their camp, so we had to make a little detour, but we are going to build that 6 miles there right through the county in trestle work, if necessary, and go over the log fellows. Further down in Georgia we struck a swamp so impenetrable that we could not get through and couldn't even build a bridge there. Lately, however, they put a large bridge there right across, resting on the islands, and the railroad companies have made a contract with us for ten years to carry our cars across that place on flat cars at \$2. We have no more difficulties except that in two or three places we have ferries in Florida that will be replaced with bridges. The great advantage of this route is that it connects the North and the South and does everything to make good feeling. We find that the tourists are going to Florida a great deal more than they did, because they can take their cars and have something to amuse them. We have 1800 miles of real good roads finished in Florida, drives that would please the Northerners so much they would always want to go to Florida. Following the drives of 400 miles from Miami to Jacksonville, this whole route is 2400 miles from Quebec to Miami, and there is only about 100 miles of it not yet in good condition. You can go over the whole route as it is, but by next year all those little gaps will be finished, and by next November you will be able, with comfort, to average 100 miles a day easy. I did that coming up. I speak of this today from the fact that we are having so much interest in this convention about how to build roads and what we are going to do and what is going to happen to the roads. Here we have got something that has actually been done, and the fruit of one of these conventions. When we held that convention in Richmond two years ago, we did not think we could do such a thing as this, yet we did it and did it so quietly that few people realize it has been accomplished. So I believe there is work being done over this country that you could take a lesson from; we get all these ideas from one another; you can take up a little road of 10 miles here and 20 miles there and get busy and accomplish these things by united effort and occasionally by bluff. We got hold of one county there that wouldn't do anything, would hardly let the road come through there. We said, "All right, we don't care, we will go down through the next county," and we started to build a road and they immediately came to the scratch and put up the money. There are several cases where we made them do that. Some would say, "That's a hot air road;" and so it is, in one sense, we did it by talking and persuasion with other people and made them do what we wanted them to do and it was not a hard job either when we got right down to business. Somebody said hot air is a thing that could be laughed at, but you remember the old hen laid over 3,000,000,000 eggs last year and two-thirds of them were hatched out with hot air in incubators. I don't know that there is much more to say about this. I could go right on telling stories about it. We have adopted a system—

we have not yet finished the work, we have now got to do the finishing up of these little places and then we have got to mark it off and we are going to have a very perfect system of marking by the color scheme. There are some of the New York State roads that we use in this route that have adopted the color system of painting the telegraph poles with yellow, blue or green according to the different routes. We have adopted a yellow and black band with an arrow, and all you have got to do in spinning along the country roads, night or day, is to follow your arrows and not bother with signs or anything of the kind, and we will have a book describing the route and will arrange with the hotel people so we can get a maintenance fund and keep a patrol and the hotel keeper will take it up and subscribe to these books and pay a certain amount towards keeping up the road, but you understand this road is not for the automobile people and tourists only, the principal use of this road will be for local use between different points and for mercantile purposes, for trade and the use of farmers. There is an immense amount of farming being done in Florida, Georgia and North Carolina and it was a great surprise to me, I never had any idea what a beautiful country there was between here and Florida until I went through it by automobile and passed through the village streets themselves instead of passing merely through the railroad depots. So people who want winter pleasure can take their car and go South and thoroughly enjoy it, and it will cost them less than it would to stay at home, almost, because everything is so cheap in the South. Living is cheap. You can use your summer clothing and live there cheaper than at home. This is an interesting subject and a subject that I think this convention ought to endorse, a subject it should take up and look into. We hope you will be interested enough in it to travel over this route when it is done and ask more questions about it and make yourself thoroughly familiar with the Quebec-Miami highway. I thank you very much for your attention.

THE CHAIRMAN: Is there any point any gentleman desires to inquire about or discuss in reference to Mr. Smith's road?

A DELEGATE: How wide is it?

MR. SMITH: That varies in different places. We merely used the roads which were built, 40- and 50-foot roads in most cases. In some cases in the south they do not build their roads quite as wide and they run down to 30 feet between banks, sometimes 30 feet between fences; the road itself is 16 feet, and in some cases they have laid the pavements 8 or 9 feet wide and laid turf and grass on the outside so that you can turn out. It is not a uniform, standard road. The upper part is a stone road, from Richmond north, and below that, gravel. Further south you get the clay and the shell roads and in Florida a great many phosphate roads. I can show

you roads which are like a looking glass, they are so smooth and hard, but in other cases they are the ordinary country roads made better. We cannot say that they are the best roads all the way down, but they are better roads than the average country roads in the North, so much so that you can travel anywhere on them with ease and comfort.

A DELEGATE: Isn't it sand roads on the east coast of Florida above Miami?

MR. SMITH: Very little of those left now, they are brick roads in some places and in other places shell roads; in other places rock roads.

A DELEGATE: Does it go through a rock ledge or mountains? I know that country; I made an examination of it myself a few years ago.

MR. SMITH: We have a great deal of that road finished now that is thoroughly good. Well, the last 200 miles down to Miami are now all finished rock road and oiled, made with coquina rock, finished last year, ground up coquina rock and rolled and scraped and oiled.

A DELEGATE: Don't it go to pieces when it gets wet?

MR. SMITH: No, since they have oiled it, it doesn't hurt it much.

A DELEGATE: Mr. Flagler is having trouble with his extension now because the material slips and slides in the water.

MR. SMITH: I don't think they have any trouble that way.

A DELEGATE: Last year they had trouble keeping it up where they filled in at the trestles.

MR. SMITH: The worst thing is that they injure the surface sometimes with those heavy trucks they have, they are using very heavy trucks. I passed through one field of 1000 acres of pine-apples and they are hauling a tremendous amount of stuff to the depots and the canning factories, but they keep it in repair.

A DELEGATE: When they strike the river going down in automobiles is it arranged so we can get across without having to wait a day or two?

MR. SMITH: There is only one place where you have to wait, and that is Rockledge; there is a small ferryboat there which carries only two cars. It will be arranged this year so as to carry more cars. Still, a tourist does not mind a little wait. You can go in

an orange grove and pick oranges or sit down and catch a lot of fish while you are waiting.

A DELEGATE: Yes, they are good oranges too.

THE CHAIRMAN: I can testify as to the character of the northern portion of this route, because its construction has been my responsibility this year. Mr. Smith referred to battle fields; there were some battles that probably he didn't know about—I refer to those I had with the contractors between Saratoga and Rouss's Point, but I think I won and you will find good roads there this year. One of the Screen Lake roads is one I have been trying to find out what kind of a road it is. Commissioner Carlisle said they got out of the car and were trying to decide whether it was a gravel road or a concrete road or a water bound macadam road, and they all differed and could not come to any agreement about it. As a matter of fact it is now presented to me for acceptance as a finished concrete road, but I think we will have to dig most of it up before we get through. Now, Mr. Hunt of Indiana desires your attention for a few moments on the matter of national highways.

MR. HUNT: I shall not detain you for any length of time and do not expect to make any talk on national highways, but there is a matter connected with national highways that you will have your attention called to, and I simply want now, in advance, to call your attention to that, and it is this, whether this convention shall, before it adjourns, endorse a resolution asking that the President of the United States appoint, from the common people of the different States, a committee to formulate and present to Congress some kind of an agreed upon plan for action at some time in the future, or whether there is enough brains and material already here assembled to formulate that plan and present it. Now there is a disagreement in the committee on resolutions on that subject and you are going to be called on to take a vote, either that we postpone any definite action or definite plan whereby we may secure federal aid and leave it to some further committee to act at some future time, or whether we are going to take up that matter and act on it now and get action at an early date? I believe it will be a mistake for this convention, composed of road men as we profess to be, to acknowledge that we have not given it the thought or that we have not the ability to agree upon some feasible, working plan and adopt it at this convention, and I think it ought to be done before this convention adjourns.

THE CHAIRMAN: Do you desire the consideration of some resolution at this session, this afternoon?

MR. HUNT: No sir, I simply want to have you think about that, in order that we may take some wise action before we ad-

journ. I think it is important that we should agree on some plan and take some action on that plan and not wait for next year or the year after or the year after that.

MR. SMITH (of New Jersey): I presume the gentleman is aware that last year we carried this whole thing through at the convention at Washington and Atlantic City, and that committee has already been appointed, three from the house, three from the senate and three from the cabinet, to find out which law was best out of the 63 presented, and this work is duplicating what has already been done, partly now and partly last year.

THE CHAIRMAN: The committee is in session and is undoubtedly considering all matters that properly come before it, and when that committee reports, there will undoubtedly be opportunity for consideration of the resolution. I regret that Mr. Carlisle had to leave; his official duties made it necessary for him to be in Albany tomorrow morning and he had to take an early train in order to get there. Are there any other questions before the meeting that you gentlemen desire to discuss this afternoon? We might very profitably continue the discussion of the destruction of roads by motor trucks. I am looking for information on that point.

A DELEGATE: You have given this matter consideration; tell us what you think about it.

THE CHAIRMAN: I am just beginning the study of it; I have not arrived at any conclusion. I think that in New York State we will probably make recommendations as to the width of tires per ton of load and put some limitation of speed upon these heavy motor trucks. Now, when a motor bus carrying passengers is late by reason of some mishap or having to pull too many people, they frequently run up to a speed of 25 or 30 miles an hour. That is too fast for those heavy trucks to run over macadam roads, and contains too many elements of danger, both to the people and to the road. Does any gentleman desire to speak further on that subject or on the subject of Mr. Smith's road or any other topic of interest?

MR. LARNGIVILLE (of Massachusetts): I want to ask a few questions of Mr. Sohier; how long has the rule been passed in Massachusetts about the weight of automobiles?

MR. SOHIER: It was passed this summer, 1913; I have forgotten just when it took effect. There's one in Michigan, I think, taking effect in a few months now. The Massachusetts law was signed on June 14th and took effect thirty days afterwards.

Adjourned.

RESOLUTIONS ADOPTED

The Committee on Resolutions, appointed by Hon. Logan Waller Page, president of the Congress, submitted the following report, which was unanimously adopted:

WHEREAS, The loss by reason of bad roads which everywhere lessens the profits of industry, increases the cost of living, and burdens business enterprise, amounts to millions annually, therefore, be it

RESOLVED, That the American Road Congress earnestly favors the creation of a national department of public works, directed by a secretary, who should be a member of the President's cabinet.

RESOLVED, That the American Road Congress favors State highway commissions and State aid for the construction and maintenance of the main roads of the several States.

RESOLVED, That the American Road Congress favors the establishment of a national road system, and favors the construction by the States, counties, and towns of the lateral and connecting market highways.

RESOLVED, That the American Road Congress respectfully requests the Congress of the United States to authorize the President to appoint a commission from civil life, with sufficient appropriation to make a thorough and exhaustive report on, and to recommend a system of Federal aid.

RESOLVED, That the American Road Congress respectfully petitions the Congress of the United States to adopt the necessary legislation, so that the United States may hereafter be officially represented at the International Road Congresses.

RESOLVED, That the American Road Congress favors the investigation by the United States Office of Public Roads of applications for patents affecting road and bridge construction before letters patent are issued.

RESOLVED, That the American Road Congress commends the Lincoln Highway Association for its efforts in seeking the establishment by popular subscription of a transcontinental highway as an enduring and useful memorial to Abraham Lincoln, and further commends the National Old Trails Association for its splendid work in the rebuilding of the Cumberland Road and the Santa Fe Trail.

RESOLVED, That the American Road Congress emphatically endorses the compulsory use of wide tires and road drags.

RESOLVED, That the American Road Congress favors, wherever practicable, the use of convicts in road construction and maintenance.

RESOLVED, That the American Road Congress favors long tenure in office of experienced and efficient highway officials.

RESOLVED, That the American Road Congress expresses its sincere thanks and appreciation to the citizens, commercial organization, and the press of the city of Detroit, of the county of Wayne, and of the State of Michigan, for their hearty coöperation and generous hospitality towards this, the greatest of American road congresses.

MICHIGAN DAY

SESSIONS OF MICHIGAN STATE GOOD ROADS ASSOCIATION

October 3, 1913

Note.—As the proceedings were of a local character, publication is omitted, with the exception of an address on "Concrete Roads" by Frank F. Rogers, State highway commissioner, and its discussion by A. N. Johnson, State Highway Engineer of Illinois.

For further information inquiry should be addressed to Hon. P. T. Colgrove, President, State Association, Hastings, Michigan.

CONCRETE ROADS

BY HON. FRANK F. ROGERS

State Highway Commissioner of Michigan

Much of value has been written in the past two years on concrete roads and pavements, but a great deal is in the nature of theoretical discussions quite largely based on laboratory experiments, hence when an opportunity is offered to make a field study of many miles of concrete roads, some of which have seen four years of service, it should not be lost.

The writer makes no claim to being a concrete expert but simply has been fortunate in having the opportunity to study at first hand, and in some detail, the behavior of a large mileage of concrete roadways in Wayne County, Michigan. This county, without doubt, has a larger mileage of concrete roadways than any other county in the United States, or than is possessed by any equivalent area under a single local government in any foreign country. There are now completed in Wayne County about 65 miles of concrete highways outside the corporate limits of cities and villages.

For reasons above stated the writer desired to spend the time allotted to him in a somewhat detailed study of the local concrete roads, which most of you will visit before leaving the city, rather than to treat the subject in a more general way. All of the main highways leading out of this city have been concreted to the outermost boundaries of Wayne County and several cross-roads have already been concreted. The principal roads are the extensions of Woodward, Grand River, Gratiot and Michigan Avenues, while River Road and the extension of Fort Street running southerly are concrete roadways that should not be overlooked.

The State highway department with the coöperation of the road officials of Wayne County and assisted by Prof. John J. Cox, instructor in highway engineering at the University of Michigan, has just taken up some detailed and rather minute observations of these roads which will extend over a period of years in the hope that after a while a safe estimate can be made of the probable life and cost of maintenance of such pavements as the county is now building, and under such traffic, soil and climatic conditions as prevail in this locality.

The first work in this study will be careful traffic records covering enough time and at such frequent intervals as will give a reliable estimate of the average daily traffic for one year. The first records were taken for one continuous week beginning August 21 and a part of this record which is given in the accompanying table will be used for the purpose of the present discussion.

The next step was to start a permanent record showing the present condition of each 25-foot section (the distance between expansion joints) of all the different roads. The observations for this record were made September 2, 3 and 4 and cover 6384 sections and a little over 30 miles of road. Several pieces of road have not been taken at this time. The oldest roads were built in 1909 and the newest that were taken were built in 1912, having been down one year.

For the purpose of this record the defects in the slabs or sections have been classified as longitudinal, transverse and diagonal cracks and holes. The records were taken in ordinary field books, the left hand column of the left hand page having been previously numbered with an automatic numbering stamp to designate the record number of each slab, while the four columns to the right were headed L—T—D—H, respectively, being the first letters of the words indicating the defects named. Opposite each number and in the proper column vertical, horizontal or diagonal marks were used for symbols to indicate the form of the crack, while small ovals were used to indicate such holes as seemed worthy of note. Tar had been spilled on many spots that were not defective.

WOODWARD AVENUE ROAD

The first mile of this road was built in May and June, and opened to traffic in July of 1909, thus giving it full four years of wear. The traffic record of this road shows a daily average of 2160 vehicles, of which 88.1 per cent were motor driven.

The soil is clay loam, inclining a little more to sand at the northerly end. A double track electric railway occupies the westerly side of the street. Between the railway and the concrete roadway is a very shallow gutter under which was laid a tile drain from 2 to 3 feet in depth. On the opposite side is an open ditch, the bottom of which is from 2 to 4 feet below the crown of the roadway.

The pavement is 18 feet wide, has a crown of 3 inches and a blind curb 8 inches wide and 4 inches deep under the outer edges which were somewhat beveled. The concrete was composed of Portland

cement, crushed field stone or cobbles and sand mixed in the proportion of $1:2\frac{1}{2}:5$ for the base which was 4 inches thick. The top layer was made of the same materials, using a $1:2:3$ mix and was $2\frac{1}{2}$ inches thick.

No very definite data can be secured to determine the wear, which seems to be slightly greater on the side opposite the railway, but measuring from some of the harder pieces of the coarse aggregate which have been worn but little, if any, we have estimated the general wear at about $\frac{1}{4}$ inch which would be an average of $\frac{1}{16}$ inch per year.

This mile was divided into sections of about 25 feet, separated by expansion joints, there being 209 sections to the mile. The most of the sections were separated by four thicknesses of tar paper separated by thin boards which it was planned to remove as the work progressed though many of the boards are still in the pavement. Four of the joints were protected by pairs of steel angle bars, separated with tar paper and placed with one leg of each angle back to back so that the other leg of each bar was flush with the surface of the concrete, thus covering a space of about $4\frac{1}{2}$ inches at the joints. The concrete wears slowly on each side of the angles leaving a raised joint that is slightly noticeable when driving over the pavement. This was an experiment which has not been repeated.

Of the 209 sections constituting the first mile on Woodward Avenue, 80 showed longitudinal cracks, 32 transverse cracks and 2 diagonal cracks while 46 sections were recorded as having holes, making a total of 160 sections which are more or less imperfect, or 76.5 plus per cent of the entire mile.

The remaining portion of Woodward Avenue, 252 sections, was built in 1910 using the same materials and the same mix. No blind curb was used and the crown was reduced to 2 inches. The soil on this section is considerably more sandy, especially toward the north end.

On this portion of Woodward Avenue, 29 sections have longitudinal, 22 sections transverse, and 6 sections diagonal cracks. 11 sections have holes, making a total of 68 defective sections or 27 plus per cent as compared with 76 plus per cent in the first mile.

GRATIOT AVENUE

On Gratiot Avenue in the season of 1910, 9000 feet of 16 foot concrete roadway was built. On this pavement gravel and sand were used for the aggregate and a one layer concrete having a $1:2:4$ mix was laid. The soil is a clay loam and rather heavy. This road was not completed until late in the season and was opened to travel in November. It immediately pitted and looked rough and has been covered with a surface treatment of refined tar and fine gravel. It was re-covered this season, using a rather light grade of tar (Tarvia A) but it already shows some tendency to scale off. The experience in some other places leads the commission to believe that a heavier grade of tar gives better results.

Beyond this portion of the roadway 326 sections of the same width concrete laid in 1911 reaching to the county line. Washed pebbles and sand were used for the aggregate in a $1:1\frac{1}{2}:3$ mix, one course concrete 7 inches deep being laid. The records for this piece are as follows: Longitudinal cracks, 11; transverse cracks, 10; diagonal cracks, 3; holes, 6; showing a total of only 30 defective slabs or 9.2 plus per cent. The traffic count on this road, taken at the county line, shows 507 vehicles daily, 65.8 per cent of which are motor driven.

GRAND RIVER AVENUE

On the Grand River Road 61 sections of two course concrete, the same as laid in the first mile of Woodward Avenue, were built in 1909. The soil is a clay loam. The records show 11 longitudinal cracks, 2 transverse cracks, 1 diagonal crack and 3 holes, a total of 17 defective slabs or 27.9 minus per cent. The traffic count showed 1064 vehicles, 56.5 per cent of which were motor cars.

In 1910, 341 more sections were added to Grand River Avenue under contract, the specifications being the same as for the north end of Woodward Avenue. 33 of these slabs became more or less pitted, some having quite large holes. They have been repaired by covering with refined tar and stone chips so that no defects could be observed at the time of the count, hence only 308 are shown in the table. The defects noted are as follows: 59 longitudinal, 20 transverse, 29 diagonal cracks and 46 holes, a total of 154 defective slabs or 50 per cent.

In 1911, 515 additional sections of one course concrete were placed on the Grand River Road. Washed pebbles and sand were used for the aggregate with a $1:1\frac{1}{2}:3$ mix. The Baker steel joint was used in all of this work except the first six sections. The defects noted are as follows: Longitudinal cracks, 8; transverse, 26; diagonal, 3; and holes 5, making a total of 42 defective sections or 8.2 plus per cent.

In 1912, 1208 more sections were added to Grand River Avenue reaching to the line between Wayne and Oakland Counties. The count on these sections shows as follows: 66 longitudinal cracks, 37 transverse cracks, 6 diagonal cracks and 5 holes, making a total of 114 defective sections or 9.4 plus per cent. The soil grew more sandy as the road extended westerly, considerable stretches being almost free from clay or loam.

MICHIGAN AVENUE

On Michigan Avenue 481 sections of concrete, 17 feet 8 inches wide were laid, using washed pebbles and sand for the aggregate in a $1:2:4$ mix. The soil for the most part is a sandy loam, but a little heavy. The count shows as follows: 219 longitudinal cracks, 48 transverse cracks, 23 diagonal cracks, 21 holes, making a total of 311 defective sections or 64.6 plus per cent. The traffic count shows 1009 vehicles, 67.5 per cent of which were motor driven.

In 1911, 1570 sections were added to this piece of road, using washed pebbles and sand for the aggregate and a 1:1½:3 mix. The soil over which this pavement was laid is a sandy loam running into light sand at the west end. The count shows the following: 219 longitudinal cracks, 80 transverse cracks, 42 diagonal cracks, 14 holes, making a total of 355 defective sections, or 22.6 plus per cent. In 1912 this road was paved to within 1¼ miles of the county line, and this year completed to the county line, but no record was taken farther west than the east limits of the village of Wayne.

RIVER ROAD

In 1910, 149 sections of concrete 15 feet wide and 6½ inches deep were laid on the River Road, using gravel and sand for the aggregate and a 1:2:4 mix. The soil over which this road runs is for the most part heavy clay. The count shows as follows: 49 longitudinal cracks, 5 transverse cracks, 6 diagonal cracks and 2 holes, making a total of 62 defective sections or 41.6 plus per cent. The traffic count shows 538 vehicles daily, of which 78.9 per cent were motor driven.

In 1911, 434 sections were added to this road some distance below the village of Trenton. The pavement was 15 feet wide, 7 inches thick, built of washed pebbles and sand for the aggregate, using a 1:1½:3 mix. The count for this stretch of road shows as follows: 16 longitudinal cracks, 17 transverse cracks, 13 diagonal cracks and no holes, a total of 195 defective sections or 44.9 plus per cent.

In 1912, the gap between this piece of road and the southerly limits of the village of Trenton was closed in with a similar pavement to that just described, comprising 213 sections. The count on this piece shows defects as follows: 14 longitudinal cracks, 8 transverse cracks, 4 diagonal cracks and no holes, making a total of 26 sections or 12.2 plus per cent.

The same year there was added to the south end of the work done in 1911 something over two miles of concrete roadway, but of this only 208 sections were counted. Of the sections counted, 17 show longitudinal cracks, 9 transverse cracks, no diagonal cracks and no holes, a total of 21 defective sections or approximately 10 per cent. The soil of the entire road was heavy clay.

FORT STREET ROAD

In 1910, one-half mile of gravel concrete of a 1:2:4 mix, 12 feet wide and 6½ inches deep was built on Fort Street. This concrete like that already referred to on Gratiot Avenue was built rather late in the season and was opened to traffic in November. It immediately pitted to such an extent that it has since been coated with refined tar and fine washed gravel, about ¼ inch in size. This covering makes an excellent surface and wears fairly well. Of course it was impossible to observe any further defects in the concrete at this time. Continu-

ing south, in 1912, 450 sections of concrete 12 feet wide, 7 inches deep, and of 1:1½:3 mix were added. The count on this piece of road follows: Longitudinal cracks, none, although another observer has reported there are 2, transverse cracks, 19; diagonal cracks, 9; and holes, 1. Total defective sections, 29, or 6.5 minus per cent.

From the foregoing, it is strikingly apparent that the percentage of defects varied greatly in the different roads. A careful study of this variation in connection with the age of the pavement will soon convince one that mere age has not produced the defects noted. For example, 252 sections built on Woodward Avenue in 1910 show but 27 per cent defective slabs, while 308 sections built on Grand River Avenue, the same year under the same specifications, show 50 per cent of defective slabs. There are two noticeable differences. Grand River Avenue was built by contract on a clay loam soil while the portion of Woodward Avenue named, was built by day labor under the direct supervision of the engineers of the county road commission, on a soil more sandy and, presumably with a little better sub-drainage. Again 481 sections built on Michigan Avenue the same year with sand and pebbles for the aggregate and a 1:2:4 mix show 64.6 per cent of defective slabs. This was on clay loam soil. We might also mention 149 sections built on the River Road in 1910 on heavy clay soil, under the specifications last named, which show but 41.6 per cent of defective slabs.

The most noticeable feature concerning these defects is that the longitudinal cracks almost always appear in groups, seldom singly. This indicates that there must be some local conditions in the foundation, due to insufficient drainage, soil conditions, newly made fills or uncompacted sub-grades that cause these defects. Longitudinal cracks almost invariably appear on fills and on cuts, apparently with as much frequency in the latter as in the former. It would seem that cracks on the fills are due to the settlement of the embankment, and in the cuts the presence of water and frost in the sub-grade. Briefly, the writer's opinion is that these cracks are due, first, to the settlement of the newly made fills, and second, to water that has not been completely removed from the sub-grade, plus frost. If these causes could be thoroughly eliminated it would seem possible to build concrete roadways to the width of 15 or 16 feet, where sufficient expansion joints are used, without fear of trouble from longitudinal cracks.

It has been argued by the Morse-Warren Engineering Company, in a recent publication, that it is impossible to build concrete pavements (wider than 12 feet) which will remain free from longitudinal cracks without using longitudinal joints, unless the pavement is so thick as to make the price practically prohibitive. The table accompanying this report which shows 450 sections of 12 feet roadway on the Fort Street Road would seem to bear out this assertion, but a mile of concrete on the Eureka Road, which the writer did not get time to inspect, shows a great number of longitudinal and transverse cracks, in a 12

foot concrete roadway, where the soil conditions are the same as on the Fort Street Road referred to. The only apparent difference is that the former is a 1:2:4 mix and the latter a 1:1½:3 mix, washed pebbles and sand being used for the aggregate in both cases.

But long stretches of pavement 16 feet wide and now two years old on Grand River and Michigan Avenues, which show no longitudinal cracks, would seem to prove that this statement is not necessarily true and that a sufficient amount of money spent in compacting and draining the foundation or in reinforcing the concrete over newly made fills, would produce pavements free from the objectionable longitudinal crease, whether natural or artificial. Most persons are agreed that transverse cracks are almost always due to defective expansion joints. It has been thoroughly demonstrated, both theoretically and practically, that 25 feet is frequent enough for the expansion joints, and it is quite possible that they might be placed farther apart with safety,—probably not less than three to 100 feet.

The diagonal cracks are doubtless due to causes which are a combination of those noted under longitudinal and transverse cracks. Many diagonal cracks were noted where the corners only were broken off, frequently on adjoining corners of adjacent slabs, indicating that the slabs were united through the expansion joints with a bond stronger than the tensile strength of the concrete on either side of the joint.

The holes noted are perhaps of less importance than the different kinds of cracks. In a few instances they are rather large, sometimes a square yard or more in area, but such places are very rare and most of the holes noted are due simply to some foreign substances getting into the concrete, like clay, wood or some fragment of an inferior rock that might chance to be a part of the aggregate. This was more noticeable where crushed cobbles were used for the coarse aggregate than where washed pebbles were used.

Any one familiar with the quality of rocks which constitute Michigan cobbles will understand that the principal objection to this material for an aggregate on concrete roads is the varying qualities of these rocks, ranging from soft to hard granite, quartzite and trap. A study of the roads where these materials have been used shows much more wear in the spots where the softer rocks happen to be at the surface.

Up to the present time the defects noted, except the pitted conditions of the concrete roads which have been re-surfaced in the manner already described, are not serious and are not causing any additional expense for up-keep. In the past two years the expansion joints on all the old work, whether reinforced or not, have been coated with refined tar and sand once a year. Thus far, the cost has ranged between \$50 and \$100 per mile, depending on the distance of the work from the base of supplies. These repairs are proving adequate and satisfactory, and while the defects noted are something of a reflection on the present method of building concrete roadways they are really

no reflection on the use of concrete as a suitable material for making hard and durable surfaces over our country highways wherever traffic conditions warrant, and the community has the ability to pay the cost of high class road surfaces. There is no question as to the necessity of some form of very permanent roadway near the city of Detroit, neither is there any question as to the ability of Wayne County to pay for roadway that is good enough and permanent enough to meet the requirements of its traffic. In the writer's opinion, Wayne county has made no mistake in choosing concrete as a paving material for its main roads.

MR. A. N. JOHNSON: All who are interested in the problems of road construction, particularly of concrete roads, are indebted to Mr. Rogers for the very valuable data that he has presented in his excellent paper, for it is only by the intelligent collection and presentation of such data that true progress in the art of road making can be made.

With so many conflicting reports afloat as to the condition of the concrete roads of Wayne County, it is particularly refreshing to have before us so concise and reliable a statement concerning them. As Mr. Rogers points out, the general condition of these roads is excellent, but as more information is usually to be gained from a study of the defects in any work, this discussion will have mainly to do with such defects and their causes and to suggest such remedies as seem to be applicable.

Mr. Rogers' paper classifies the defects noted in the Wayne County roads under four heads; longitudinal cracks, transverse cracks, diagonal cracks and holes or pits in the road surface. It remains to be seen whether the exact causes and consequently the proper remedies for these defects can be determined from our present knowledge. The last of these defects will be discussed first, as there is probably less doubt as to the causes.

It is evident that if one portion of a concrete road surface, under given conditions of traffic, exhibits a special weakness, it must be due to non-uniformity of the concrete. This will happen if soft pieces of material are in the aggregate. Many gravel banks contain enough soft pebbles to render the gravel useless for concrete road work, though frequently these soft pebbles have somewhat the general appearance of the sound material and, unless a careful examination is made, will not be detected.

Another cause for local weakness in concrete is the un-uniform distribution of the mortar and the aggregate. It frequently happens, particularly with very wet mixtures, that the coarser aggregate will not be thoroughly distributed, but will occasionally be separated into small collections or nests of the larger pieces, which contain a very small amount of mortar. There is no mixer that has come under the writer's observation which will mix a batch so uniformly and deposit it in the road so that all portions will contain the proper

amount of coarse aggregate and mortar. It is necessary, therefore, in the construction of a concrete road to have one or two men constantly at hand to correct such uneven distribution by shoveling out the pockets of coarser aggregate to be found in the center of nearly every batch that is deposited on the road and replace these pockets with mortar, which usually runs to the bottom and edges of a batch. Where the holes or pits in the road surface are few, their cause is probably due to one or both of the above mentioned reasons.

Where the surface exhibits a more general disintegration, it will usually be found due, assuming a rich mixture has been used, either to the concrete drying too fast during the period of setting, thereby not curing properly, or because it has been frozen while setting. It is assumed in this discussion that a rich enough mixture has been employed to insure good concrete, although most complete failures of concrete roads are due to a too lean mix and poor workmanship. All of these causes are generally well understood and most specifications and approved workmanship seek to avoid them.

The causes of the first three defects noted by Mr. Rogers are perhaps more difficult to ascertain in a given instance. Before taking up the discussion of the causes, it is of advantage to rearrange the data as presented. This has been done by grouping the data according to the year in which the roads were built, or in other words, according to the age of the various pieces of road. And in order to have a proper basis of comparison, the number of cracks per mile has been computed for the roads built in 1909, 1910, 1911, and 1912, respectively. The results are presented in the following table:

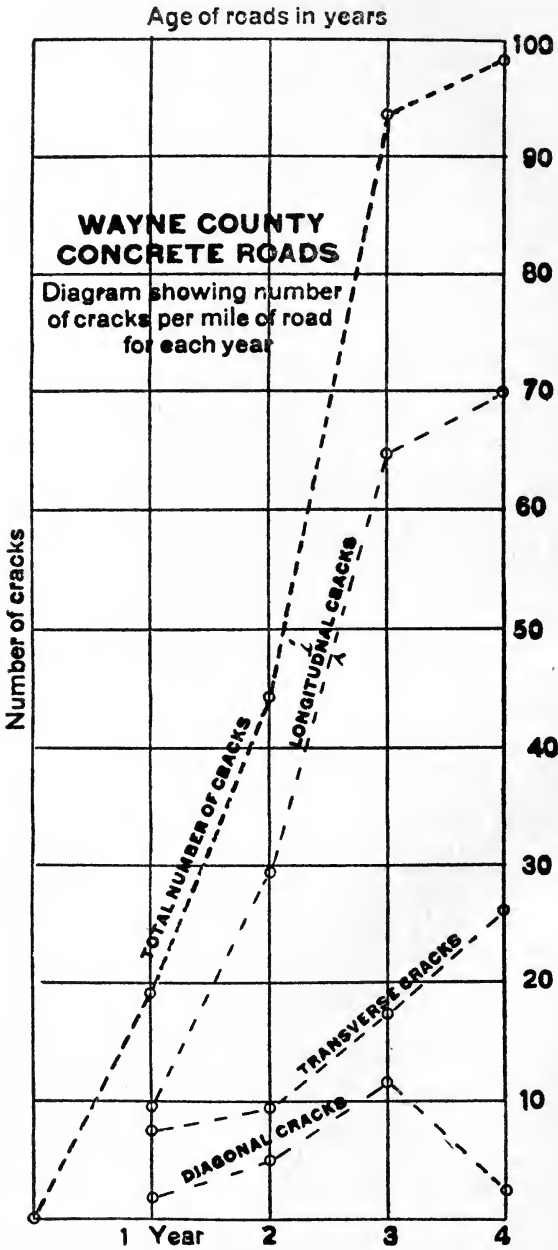
TABLE I
Showing the cracks per mile for each year

	CRACKS PER MILE			
	1912	1911	1910	1909
Transverse.....	7.4	9.9	17.3	26.2
Longitudinal.....	9.8	29.8	64.8	70.0
Diagonal.....	1.9	4.5	11.7	2.3
Totals.....	19.1	44.2	93.8	98.5

The results in this table are represented graphically in figure 1, where the age of the pavements in years is plotted as abscissas and the number of cracks per mile as ordinates.

At a first glance, one is struck with the increase in the number of cracks with each succeeding year. This increase is particularly marked during the first three years, but apparently falls off sharply during the fourth year.

A notable coincidence is that the curve showing the total number of cracks per mile of all kinds is approximately a straight line for



the first three years, or in other words, the increase in the number of cracks was approximately the same for each of these years.

There is also considerable agreement of the curves for the longitudinal, transverse and diagonal cracks during the first three years, but no such agreement for the fourth year. It is to be borne in mind, however, that for the fourth year, data are given for only two pieces of road about 1.3 miles in length. However, as these were laid with a leaner mixture than much of the other work and is the first concrete work done by the Wayne County commissioners, all the evidence would point to the conclusion that this stretch of road would show at least as many defects as will appear later in the other roads. But whether the conclusion can be definitely drawn that after the first three or four years but few more cracks will appear must rest on much more extended and detailed data than are to be had at present.

The value of future observations to be made at intervals of not less than three months will be evident. These observations should note carefully all the cracks that are found, both as to their character and particularly as to their distribution, so that in the future, the location of new cracks as they appear may be known, as well as approximately the time of the year when they occur. It is believed that the data secured from such observations extending over the next two or three years would shed much light on what at present can be but mere conjecture.

Before the arrangement above described was made of the data presented, many other bases of comparison were undertaken with a view to ascertain whether any particular feature had a special bearing on the occurrence of the cracks. There was not, however, disclosed anything on which conclusions could be logically based. Neither the width of the road, the proportion of the mixture nor the character of the sub-soil presents any unfailing influence on the defects noted. About the only consistent result to be disclosed was by the arrangement here made.

It may be profitable, however, at the present time to discuss the causes that may be assigned to the development of cracks in concrete roads, basing the observations on the data obtained from the conditions reported on the Wayne county work.

It can be fairly assumed in the present instance that the slabs of concrete may be considered as approximately of the same strength and therefore offer practically the same resistance to all exterior forces to which they are subjected.

Among the forces which would cause the slabs to crack are variations in temperature, extraordinarily heavy traffic loads and unequal settlement of the foundations. It is more than probable that the cracks are due to no one of these causes alone, but rather to their accidental combination. If the changes in temperature were the prime cause, it could be expected that all slabs would show approximately the same number of cracks for the reason that all

portions of the road are subjected approximately, to the same temperature variations. But an examination of the roads shows many slabs in continuous stretches which have not cracked at all, regardless of the age of the road. It can therefore be concluded, that temperature changes alone, are not sufficient to cause cracking of the slabs in general.

While extraordinarily heavy moving loads may not be so generally applied to all the slabs, and therefore not cause as uniform an appearance of cracks, yet if this be a principal cause, it could be expected there would be a large number of contiguous cracked slabs. But there is practically no evidence to indicate that there have been loads heavy enough to cause the pavements to crack from this reason alone.

The third cause that has been mentioned, that of unequal settlement of the foundation, is one that would not be generally distributed, for while settlement might occur in one place, there very likely would be considerable distances where it did not occur. Moreover, it will be appreciated that the manifold conditions which would produce unequal settlement would cause an erratic occurrence of any results from this source. And the haphazard occurrence of the cracks would indicate that the cause is not general throughout the length of the roads. The writer is therefore of the opinion that the majority of the cracks are due primarily to unequal settlement of the foundation or sub-soil beneath the broken slabs.

It is quite possible that settlement by itself would perhaps not be sufficient to cause the slab to crack, but on the passage of heavy traffic or with the movement of the slab under temperature changes, there would be added just enough extra stress to overcome the strength of the slab and produce the crack. If, therefore, it is possible in the construction of concrete roads, to guard against unequal settlement of the foundation, one of the chief sources of cracks in the pavement will be overcome.

The writer has observed that the concrete slabs composing a concrete road, usually do not crack until after they have been in service about a year. The first cracks generally appear during the late spring and early summer following construction. An explanation is that during the winter and early spring, the ground is well saturated with moisture which during late spring and early summer dries out and, in case the road bed should dry out unevenly, the consequent settlement would not be uniform.

It is, therefore, particularly important if large concrete slabs are to be maintained intact, to take special precaution with the under-drainage to protect the road bed from becoming saturated and provide a means for thorough and uniform draining of the entire road bed.

It is probable, as further studies are made, that the causes producing transverse cracks will be found to be somewhat different from those producing longitudinal cracks. One special cause of the latter is to be found whenever a concrete road is built over a hard roadbed, the

concrete slab being somewhat wider than the compacted center of the old road. The soil at the sides which is not so compact as the center, will settle more, causing the concrete slab to break longitudinally, with the road. To prevent this, it is recommended that the old road bed should be thoroughly loosened and then re-rolled with the sides so as to produce as nearly uniform a condition as possible, of the entire road bed beneath the concrete.

It is to be noted that on all the Wayne County concrete roads, the distance between the joints is 25 feet. Mr. Rogers suggests that a somewhat greater distance may be used.

It has been the writer's experience, that it is not necessary to place expansion joints as close together as 25 feet. It will be readily admitted that the fewer joints, the more desirable the road surface. The following data will perhaps be interesting in this connection, although too meagre to draw very definite conclusions.

On three pieces of work constructed under the writer's supervision in 1912, totalling 2.3 miles, none of the sections was less than 50 feet in length, many of them being 60 and 75 feet and one or two as long as 100 feet. The number of cracks per mile in these roads at present is, transverse cracks, 9.1; longitudinal cracks, 9.1. As none of the cracks have been classed as diagonal cracks, the total number of cracks per mile is 18.2, but it will be noted in Table 1, that the total number of cracks in the 1912 work on the Wayne County roads, using 25-foot sections, is 19.1. If therefore, with 50-foot sections and greater, there are no more cracks per mile than with 25-foot sections, it is evident that we do not need joints as often as 25 feet and when we consider that every joint is really a crack which must be cared for and maintained, it is evident that their reduction is a very substantial gain, both in first cost and subsequent maintenance. However, it will be necessary to have much more data, extending over a much longer time before it can be definitely concluded as to how frequent the joints should be; but from the observations that have been made it seems that the joints may be made further apart than 50 feet, rather than nearer together.

Before concluding, the subject of the mixture to be used should be touched upon. A concrete proportioned 1-2-3½ is amply rich enough to give the requisite strength required for road service. It is to be noted that this mixture provides sufficient sand to furnish a quantity of mortar approximately 60 per cent of the volume of the coarse aggregate. As was pointed out by the writer in a paper on concrete road construction, presented last year, to the American Road Congress, it is important that if all the aggregate is to be well surrounded with mortar, that with aggregate showing 50 per cent voids, the sand should be in excess of one-half the volume of the coarse aggregate. Actual service has demonstrated the value of proportioning concrete in this manner, rather than using a 1-1½-3 or a 1-2-4 mixture.

Lest a wrong impression should be gained from the emphasis laid upon the defects found in the Wayne County roads, the writer

would state in conclusion that the average crack in a concrete road is but a minute affair and is easily and cheaply filled with pitch so as to present to traffic an unbroken road surface. And from a number of personal inspections made of the Wayne County roads, he feels that the Wayne County commissioners have amply justified their adoption of this form of construction and deservedly merit the approval bestowed upon them, not alone by Wayne County citizens but by all who appreciate skillful and painstaking construction of public work.

AMERICAN ROAD CONGRESS

Detroit, October 4, 10 a.m.

President Page in the Chair.

THE CHAIRMAN: The meeting will please come to order.

SECRETARY PENNYBACKER: The principal business of this morning is the consideration of invitations from various cities for the 1914 and 1915 American Road Congress. The committees representing the two organizations, the American Highway Association and the American Automobile Association, conferred with the gentlemen representing the various cities, on Thursday, and have gone over the various communications and the verbal information rather thoroughly, and as there are a great many telegraphic invitations and letters, the committee hardly thought it worth while to have them all read at this particular meeting. The committee has determined to withhold its final decision for a few weeks until a representative of the Congress could personally inspect the facilities for meeting places, exhibits, hotel accommodations, etc., of the various cities that might be selected. The committee does not mean by this that a tour of the whole country will be made, but they will have an inspection made of the three or four cities which they have determined upon in the final analysis, and unless there are some special communications that it is desired be read, these will be made part of the official record and not be read at this meeting.

THE CHAIRMAN: If there is no objection to placing these various requests and invitations in the record, we will allow them to go in the record. If there is any one present representing any city that desires our congress to be held there and has anything special to say on this subject, we will be very glad to hear from them.

(Representatives of various cities then presented invitations, together with arguments why the Congress should meet in them, after which the Congress adjourned.)

MEETING OF AMERICAN HIGHWAY ASSOCIATION

Detroit, October 2, 8 p.m.

President Page in the chair.

The meeting was called to order by the president after which the secretary read the minutes of the last meeting, which was held in Atlantic City, New Jersey, October 3, 1912.

Upon motion the minutes were approved as read.

There being no unfinished business Mr. Batchelder moved that a committee of seven on nominations be appointed. The motion was seconded and adopted. The Chairman appointed Messrs Batchelder, Beatty, Johnson, Wilson, Kenyon, Colgrove and Goodell.

The committee then retired.

Secretary Pennybacker then submitted his report and the Treasurer's report, the latter official being absent. These reports had been submitted to the board of directors on the evening previous and approved by them. Mr. Pennybacker stated that the total membership was 1670, the largest ever recorded; that this number represented the bona fide, practically permanent membership. He called attention to the second official *Good Roads Year Book* which was brought out two months earlier than the first one and contained one hundred pages more matter as well as a number of new features. He also stated that the proceedings of the 1912 Congress had been issued and had been distributed to the members.

Upon motion the reports of the secretary and treasurer were adopted.

The president in a few brief remarks called attention to the fact that there had been a joint committee of the Senate and House of Representatives appointed to consider the matter of national aid in road building; that he felt particularly proud of the fact that the secretary of the Association had been made statistician and had done splendid work. He called attention to the further fact that the secretary had recently been selected by the government of Ontario to aid them in framing suitable highway legislation.

Upon motion of Mr. Diehl, duly seconded, the Association adopted by rising vote, the following resolution:

RESOLVED, That a vote of thanks be extended to the people of the city of Detroit and Wayne County for their splendid hospitality and helpful coöperation, and to the representatives of the press for the splendid, comprehensive and instructive publicity, which they have given to the sessions of the Congress.

While waiting for the committee on nominations to make its report, the president called upon several gentlemen present for a few remarks. The first speaker was Judge Lowe.

Judge Lowe gave a brief talk and among other things, said, "I do not know when I first began attending road conventions, but I have never attended a road convention that impressed me with its intelligence, its deep and abiding earnestness and its all round intelligence as this convention has done. I believe it is the greatest road convention ever held in this country. I will except Europe and the foreign countries because I have not had the pleasure, like Colonel Kenyon and others who are with us tonight, of attending conventions in those countries, but this convention has certainly set the pace, and I cannot, for the life of me, imagine how it is going to be possible for the next Congress to avoid taking a definite position on the question of national roads."

THE CHAIRMAN: I know that we would all be delighted to hear from Gen. Geo. J. Schoeffel.

GEN. SCHOEFFEL: I did not come here, Mr. President, prepared to speak, but to listen, and I have been surprised at the excellent work of the Congress. I was prepared to see good work being done; but certainly this has surprised me and I shall go back to New York and report to my superior officers—make a report to them that they will be very much pleased with.

The president then called upon Colonel M. V. Richards who was present as a representative of Mr. W. W. Finley, the president of the Southern Railway.

Colonel Richards gave a very interesting account of his experience, covering a number of years, to educate the people in the southeastern part of the United States to a better realization of the importance of developing public roads. He expressed his gratification at being present at the Road Congress, because, as he said, "I see here a large congregation of gentlemen from various parts of the United States, every individual a forceful factor in the good roads movement, and I am especially glad to see these people brought together, affiliated here, with this one organization, which I believe, gentlemen, is paving the way for a movement which will be of everlasting benefit to the people of the United States in advancing the development and improvement of the roads in this country."

Mr. W. T. Winn then addressed the meeting, expressing his pleasure at the success of the Congress, and in a very forceful manner urged that the next Congress be held at Atlanta, because of the intense interest being displayed by the people of the South in this great movement for better roads.

Mr. Diehl then took the chair, and the committee on nominations presented its report which was as follows: "For president, L. W. Page; for vice-president, W. W. Finley; for secretary, J. E. Pennybacker; for treasurer, Lee McClung; for field secretary and organizer, Charles P. Light; for directors for three years, Alfred Noble, J. W. Jones, T. G. Norris, James S. Harlan, L. E. Johnson, Roy D. Chapin, Charles Whiting Baker and Austin B. Fletcher.

On motion of Mr. Batchelder, duly seconded, the report was adopted.

The chairman stated that the gentlemen mentioned in the report had been placed in nomination, and Mr. Beatty moved that the secretary cast a ballot of one for the nominees as recommended by the committee on nominations. The motion was then seconded and adopted.

The chairman declared these officers elected and escorted President Page to the chair.

President Page, in a few well chosen remarks, thanked the Association for the honor and, among other things, said:

"Gentlemen, I know a great many of you attribute the credit for the success of our organization to me, but I wish to say that the credit for our success is due, in my judgment, first and foremost, to Mr. Pennybacker and Mr. Light. I have never known two men who have worked harder and on a higher plane than our secretary and field secretary. Their work has been indefatigable. They have received many enticing offers to go with other organizations, but they have stuck steadfastly to our work and I hope somebody will make a motion for a vote of thanks to them. . . . Now, I like to hear good roads addresses but I have hardly been able to stay up in the convention hall because I have learned so much in going around through the splendid exhibits, and I think it is a most liberal education, to a person interested in road work. I hope, gentlemen, that next year, wherever we meet, we shall have an even greater success, if possible, than we have met with this year. I wish very heartily to thank you for the honor you have shown me in electing me president, and I hope that I may be worthy of your trust and confidence. I thank you."

Mr. Kenyon moved that a vote of thanks be tendered to the officers of the Association for the good work which they had done. This motion, duly seconded, was unanimously carried.

Colonel Washington made a few remarks, stating that he had attended the Third International Road Congress in London and that the exhibition at this Congress exceeded, by 50 per cent if not 100 per cent, in the number of exhibitors, in the variety of exhibits and in the interesting character of the exhibits, notwithstanding that the exhibits shown at the International Exhibit, were participated in by thirty-two nations and held in London, where Germany, France, Italy and all the continental countries had a very excellent opportunity to participate: that this Congress had taken up many more subjects with much broader discussions.

There being no further business, the meeting, upon motion, duly seconded, was adjourned, sine die.

PROCEEDINGS
OF THE
FOURTH
AMERICAN ROAD CONGRESS

UNDER AUSPICES OF
AMERICAN HIGHWAY ASSOCIATION
AMERICAN AUTOMOBILE ASSOCIATION



Price \$1.00 postpaid

ATLANTA, GA.

NOVEMBER 9-14, 1914

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ATLANTA, GA.

NOVEMBER 9-14, 1914

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Proceedings of
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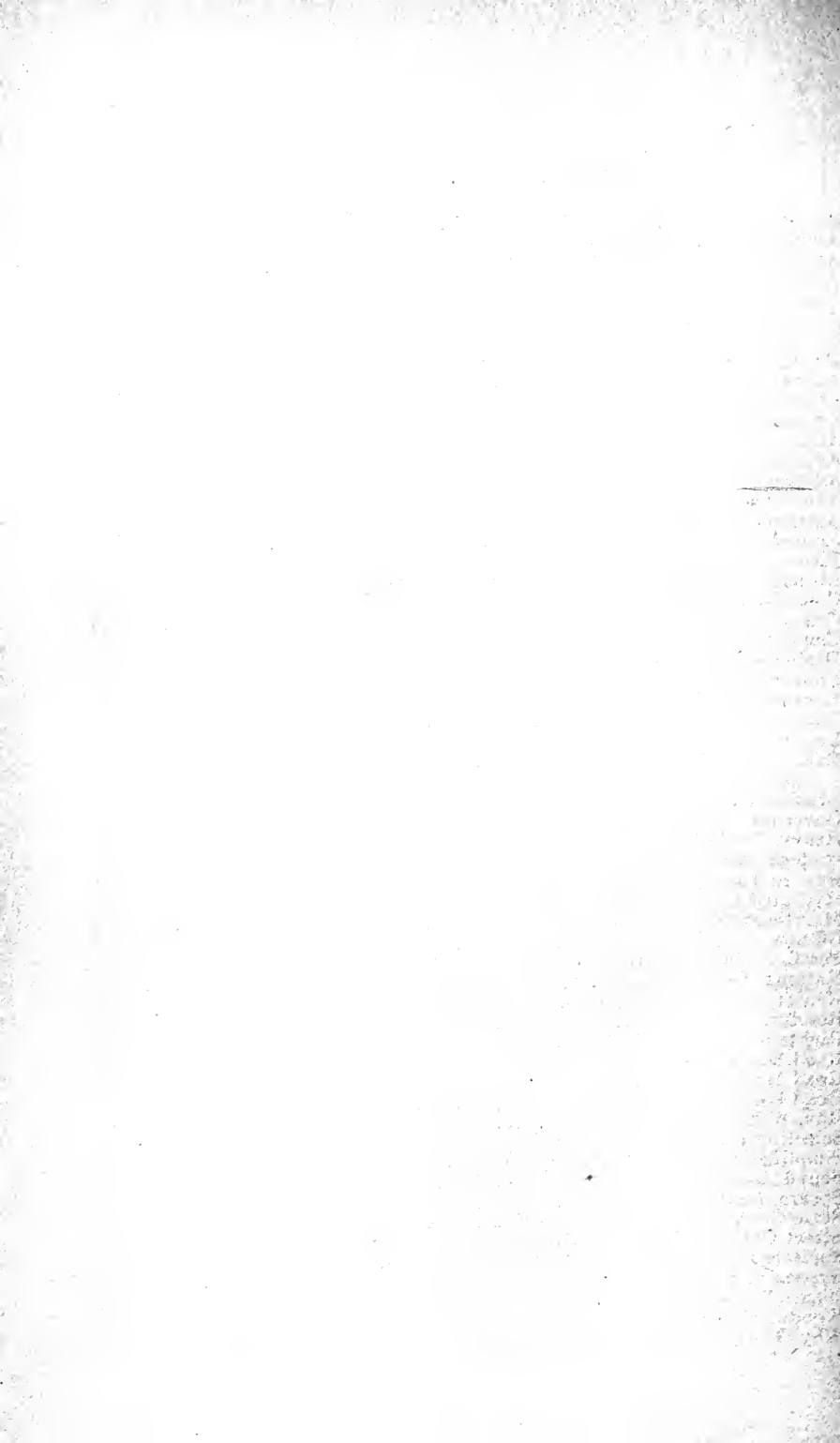
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FOURTH AMERICAN ROAD CONGRESS

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AMERICAN HIGHWAY ASSOCIATION

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COUNTY COMMISSIONERS ASSOCIATION OF GEORGIA

ATLANTA, GEORGIA

November 9th, 1914, 10 A.M.

PRESIDENT A. B. FLETCHER IN THE CHAIR

THE PRESIDENT: The Convention will please come to order. I have the honor to introduce the Right Reverend W. A. Candler, Bishop of Georgia.

DR. CANDLER: Let us pray: Our Father in Heaven we worship Thee as the Father of our Lord Jesus Christ from Whom cometh every good and perfect gift. We are grateful for Thy goodness unto us. Thou hast not dealt so with any other people. Thy providence has been over our nation through all the years as a very pillar of cloud and of fire. We thank Thee that our people are at peace, that the rude cries of war are not heard nor is there lamentations in our streets because they come not back who have gone in to the conflict. Thou hast given us abundant resources of every sort. We pray Thee to bless us with grateful hearts and faithful spirits that we may fulfill the mission set before us by the divine providence over us. Bless this assembly of men here met to consider a great interest that affects the social and moral and material welfare of our people; and the blessing of Almighty God be upon them individually and collectively that wisdom may characterize their conclusions and harmony their proceedings and that good may come to our land and as we affect other lands, to all lands through this meeting. God be merciful unto us and bless us and cause His face to shine upon us, that His name be known in the earth, his saving health among all people. We remember this day to pray for the stricken and disturbed peoples grappling with one another in contest of war. Oh Thou Prince of Peace, calm this combat, bind up the broken hearted and subdue the passions of men and let good prevail over all evil. Guide us by Thy counsel whilst we live and afterwards receive us into glory through Jesus Christ, our Lord. Amen.

THE CHAIRMAN: I have the very great honor to present to you the Hon. John M. Slaton, Governor of California. (Laughter)
—I mean Georgia.

GOVERNOR SLATON: *Ladies and Gentlemen:* I suppose it was designed when the President introduced me as the Governor of California. The idea is that if we have good roads, all distances will be annihilated; California will be about as close to Atlanta as some parts of Georgia. The truth is that one of the benefits of good roads is this unification of the people and the introduction of them to each other. It is particularly appropriate that you should meet in Georgia. You understand that in 1834 the State of Georgia built the first State constructed railroad and it still owns it, a railroad between Atlanta and Chattanooga; and a railroad is nothing in the world but the evolution of a good road. We recognized the effect of transportation upon the welfare of the people and therefore we appropriated the money at a time when the people were in hard straits, in order to accomplish the purposes for which you have met. Now we all are acquainted with the benefit, in a general way, of good roads. We understand the effect upon the school-house and upon the church and upon rural life; we understand that it relieves the farmer of his burden of transportation, that it aids in the construction of homes in communities where Nature can be enjoyed and where congested communities may be relieved, but we are glad to have you because you come for a practical purpose. You are with us to instruct us. There was a proud old house in Europe whose motto was "I serve," and you gentlemen and ladies have come here in order to serve the State of Georgia. Our State is alive to the purpose for which you are organized. We appropriated in 1911 \$4,500,000 for the purpose of good roads. This includes, of course, the service of the convicts upon the roads, and we utilize them for that purpose and find that it is in accordance with wise penology as well as producing a return to the people for the expense which these criminals occasion. But there are problems that come before us as to the construction of roads. What we need now are not platitudes but specific advice. Problems are coming before us constantly as to the construction of roads—the engineering questions which arise—the question of upkeep, the question of materials from which they could be constructed; and therefore to you gentlemen we look. You represent the highest and most trained intelligence in the United States upon the subject to enlighten us. You will find that all over Georgia there are County Commissioners and those who have the matter of construction of roads in charge who will be present and listen to what you all have to say, and when you are gone the seed you have sown will serve to benefit the State and its people. This idea of service is that which is abroad everywhere. I read the other day that the Japanese conquered Russia not by the valor and gallantry

of their soldiers but by the skill and capacity of their engineers, and the battle was won by shooting over mountain tops by those who had calculated with the theodolite and knew the measure of the angle. You gentlemen, therefore, and ladies, have come to give us that information and when you have gone the effect of your visit will be remembered, not only for the social influence you have exerted, but because of the information you have left. Allow me to say that the people of Georgia are a kindly and generous people and in their behalf I welcome you into our midst. When you shall have left, I hope you will carry with you the kindest recollections of a people in whose behalf I welcome you.

THE CHAIRMAN: I take pleasure in introducing the Honorable James A. Woodward, Mayor of Atlanta.

MAYOR WOODWARD: Mr. President, members and visitors of the Fourth American Road Congress: It is always a pleasure rather than a duty placed upon the Mayor and the Governor of the State and city to give expression to words of welcome. I know that so far as Atlanta is concerned, it needs no words from me to tell you that you are welcome to this city. You are, and we are glad to have you. We want you to feel while here that the latch string of every door is open to you; if you don't see what you want, ask for it and it will be shown you. You are within the walls of a city that is somewhat remarkable. Take the life of it; there are few American cities that can come anywhere near to what it has accomplished. I do not refer to it in any spirit of alluding to war times, but take it from that time on. There was then possibly only ten or twelve thousand inhabitants in Atlanta. It reminds me—for I was here right after that fateful period—of what I read about what is going on in the old country now, the towns and cities that are being devastated. That was the condition of Atlanta at that time. People had come home without a dollar to invest but with all the desires and pluck and energy to build up their homes in a devastated country; and went to work. So you can see that Atlanta is really a city of about 40 years, and take all of its actual life since it was in the woods and it is in the span of a man's lifetime of three score and ten; but Atlanta as you see it today has grown within the last 20 or 25 years, even within the last 15 years. Fifteen years ago there was not an office building here except the Equitable Building. They have all been built within that time. Atlanta prides herself on being a city of more fireproof buildings—office skyscraping buildings—than any city of twice its size within the confines of the American continent. I imagine that a good many of you people who have come here from the west and the north, when you get into our streets, thought something of home. Now for the past 25 years we have given a great deal of time and a great deal of money has been expended in street buildings. I have not the exact figures with me

now, but I should say that Atlanta has close to 200 miles of paved streets. The leadway that Atlanta has taken in such measures as that has gone a long way toward encouraging the people in the country to build good roads, and as the Governor has well said, within the past few years they have turned the convicts from the lease system to that of appropriating them to the different counties for the purpose of building roads, and there is no one thing that I can call to mind that will do more toward the upbuilding of our country than the building of good roads. To the truth of what I have spoken to you as regards Atlanta and Fulton County, our County Commissioner will show you before you leave here. We are well provided—while we have not got enough—yet with good roads in Fulton County. You have got a convention here that is not only an educational one to our people in Atlanta, but to people from all over the country. You come here largely—one element at least—to display your road making machinery. The delegates to this convention have come here to investigate and satisfy themselves and see for themselves what class of machinery will aid them best in their work. It was quite appropriate for you to meet at this time in the gate city of the South, where possibly the building of good roads and the advancement of good road machinery is more necessary. It has been said that the advent of the automobile created extravagance, and possibly that is true in one line, but we must all admit that the automobile showed us the necessity for good roads; [applause] and in that manner was a blessing to the country and to humanity. Now in conclusion allow me to say that Atlanta extends to you a most gracious welcome. We are glad to have you within our city. We want your stay to be as pleasant as it can be made, and when the time comes for you to depart, we want it arranged in such measure that you will go away from Atlanta with a kind word, a good taste in your mouth for this city and may that all wise Being who is overlooking those loved ones you have left at home, preserve them in their good health until you return. Before I take my seat, I would like to inform all of the municipal people here—while we appreciate everybody that is in attendance on this convention—that the City Government desires that they register at the City Hall. We wish to meet you and give you what attention we can.

Mr. Page takes the chair.

THE CHAIRMAN: Next on the program is the response by President Fletcher.

PRESIDENT FLETCHER: *Mr. Chairman and Gentlemen:* The warmth of our welcome, the refreshing completeness of all the measures that have been taken for our comfort and the spirit of enthusiasm displayed by this great gathering of good roads workers makes us all from north, south, east and west glad that we are here. To His Excellency the Governor of Georgia and to his

Honor the Mayor of Atlanta, I desire to express, on behalf of the delegates and visitors to the American Road Congress, their deep appreciation of this magnificent welcome. To those of you who are attending the American Road Congress for the first time, it may be of interest to hear a word or two as to why this great national road meeting has become an established institution and a necessary factor in the working of the fundamental problem of road improvement. Interdependence of city and country, of producer, of shipper, of consumer, has developed to such a degree that the public road once of local importance has become of state wide and in many instances of interstate importance. This necessitates a readjustment of the burdens of cost, a recasting of the regulations of traffic while all this great passenger and freight traffic that now weaves in and out on this network of roads, has produced conditions of wear and introduced agencies of destruction which make new and difficult problems of construction and maintenance for the engineer to solve. We are here therefore to discuss and devise better legislation, better systems of finance, better traffic regulations; to learn by discussion and exchange of experience of the types and of the methods of roads which are best adapted to meet the conditions of traffic which confront the highway engineer. We are here to urge that the time has come to take the public road out of politics, to handle it as we would a great business undertaking, and to urge the creation and development of a nation-wide corps of trained and efficient men who will make road building and maintenance their life work. Gentlemen, you will hear these great questions discussed in detail at the various sessions of the Congress and I merely mention them at this time in the hope that you will take the proceedings of this Congress most seriously and devote every faculty of mind and heart toward making this year's Congress useful to the American people in the highest degree.

President Fletcher takes the Chair.

THE CHAIRMAN: I have the honor to introduce to you the Honorable Logan Waller Page, Director of the United States Office of Public Roads and President of the American Highway Association.

Mr. President and Gentlemen: The fact that men eminent in the good roads movement are here from the far off Pacific Coast, from the Northwest, from New England and in fact from nearly all of the forty-eight states of the Union, demonstrates conclusively that the question of road improvement is no longer of merely local significance. It is proof that this great question is of nation wide importance, and well it may be so considered, for it touches human welfare at every angle and is a material factor in the development of education, in our home life and in religion, the three great fundamentals of our civilization.

You will hear during the sessions of this Congress the experience

and the advice of the best known specialists on every phase of this great subject. I shall confine my remarks therefore to a few comments on what has been done to further the road movement during the past year, and along what lines we may hope for results during the year 1915.

The Office of Public Roads, has an organized corps of collaborators composed of one representative at each State capital who makes monthly reports to the Office showing what has been accomplished in the State and what measures are contemplated or pending. Through this source of information we have ascertained that the year 1914 has added to our mileage of hard surfaced roads a total of 18,000 miles, which means that in the short space of twelve months we shall have added to our road system a mileage three-fourths as great as the total length of the National Roads of France.

We are spending money on our roads with a rather free hand. Last year our total outlay, in money and labor, was in excess of \$205,000,000, and I think we are safe in saying that the aggregate will reach \$225,000,000 this year, or more than an average of \$100 per mile for every mile of highway throughout the United States. This average looms up as a rather impressive figure when I say that according to the best information available 20 per cent of the roads in an average county carry 80 per cent of the traffic. This great annual expenditure, therefore, if pro rated on the basis of the really important roads gives an average of something like \$500 per mile per annum.

Our system of road management is admittedly wasteful and inefficient except for the few shining exceptions here and there, and I firmly believe that with good business methods and skillful supervision we could save not less than \$50,000,000 per year and obtain better results than we are now obtaining.

An exceedingly important factor which has come into prominence in solving our road problems during the past ten years is that of convict labor. Many of the States are using their convicts in the building of roads and in the preparation of road materials, and I congratulate the State of Georgia on her lead of all States in this respect, for Georgia, I understand, now has a great road-working army of more than 5,000 convicts which are rapidly transforming the road system of the State. We have estimated that the total convict labor days on road work throughout the United States in 1914 will exceed 3,000,000.

As indicating the trend of this movement I may say that during the year the States of Ohio, New York, Wisconsin and West Virginia have authorized the use of convicts in this way, thus indicating that this policy has no geographical bounds to its field of usefulness.

I wish particularly to call your attention to the work of the United States Office of Public Roads, not from any desire to boast of the results which we have accomplished, but in order that you may

understand the way in which this service of the government may be utilized to help your own local problem, if you need such help as the government may give.

During the past ten years our engineers have supervised in all parts of the country the building of what we term Object Lesson Roads for the purpose of giving to the local officials direct instructions and advice on the best methods of construction. Recently we have found that an even more important problem is that of maintenance, for the practice is all too common of building excellent roads and then leaving them to disintegrate under the action of weather and traffic. Probably the most striking demonstration in proper methods of maintenance which has ever been undertaken as an Object Lesson was inaugurated by the Office of Public Roads last March at the suggestion and in coöperation with the American Highway Association.

Sections of road forming a continuous stretch in twenty-eight out of forty-nine counties between Washington and Atlanta have been voluntarily placed under the direction of government engineers by the county authorities and cash appropriations made for expenditure in such manner as these government engineers may direct.

To facilitate the work and to permit the engineers to cover a relatively large territory, the American Highway Association supplied without cost to the government or the counties, three automobiles. I think I am perfectly justified in saying that the improvement on these roads has equalled the most sanguine expectations of those who inaugurated the project.

I have mentioned these examples of government work to indicate to you the basis upon which the government's assistance is granted. There are many more projects under way designed to further the building and maintenance of good roads in accordance with sound economical principles and good engineering practice, and I wish to emphasize that all of the assistance which the government renders in this work is without any cost whatever to the local communities.

I shall not review the work of the American Highway Association during the past year, as this information will be given out in the various annual reports of the officers and committees of that organization; but I wish to comment most particularly upon a project which holds as great possibilities, in my judgment, for the betterment of road management as any one project which has ever been undertaken.

Last year at the Third American Road Congress a committee was appointed to take steps looking to a revision of State Road Laws. At the request of the committee the Office of Public Roads prepared a literal compilation of the Road Laws of each and every one of the forty-eight States, and the result is a huge accumulation of words exceeding 3,500,000 in number. This great manuscript is being cross-indexed and I understand that the committee will get in active touch with each State Legislature in an effort to bring about a

simplification and a revision of the Road Laws at the earliest possible moment. All that may be done along this line will be of lasting benefit and will be enough of itself to justify a continued support to this great organization.

Within the past few months steps have been taken towards bringing to the support of the road movement, the united efforts of women in every county and in every community throughout the United States. This work has taken definite form through the establishment of a women's department of the American Highway Association, with Mrs. Robert Baker, of Washington, as Chairman. The first conference under the auspices of this department will be held in the city of Atlanta tomorrow, and I am glad for the success of the movement that it is being launched here where it will profit by the wonderful Atlanta spirit of progress. I hope and believe that the women will accomplish marvelous results in bringing about through moral suasion an improvement of road conditions in rural communities, and in so doing help the cause of better schools, better churches and better homes.

I will not go into any detailed statement of the objects and working plan of the women's department, as this will be fully covered by addresses to be given later on in the week. I may say, however, that this work is designed to introduce particularly better road management and better maintenance of our public roads.

I know that it is customary for speakers to extol all the good qualities of the cities in which meetings are held; but I wish to say more than the usual words of appreciation of Atlanta's splendid hospitality and cordial spirit of coöperation. Not in my whole experience in attending conventions have I come in contact with a courtesy so all-pervading, with a spirit of helpful coöperation so timely and practical, and with a knowledge of what needs to be done, and the energy in doing it, such as has been displayed by Atlanta in connection with this Congress. The arrangements are complete to the most minute details, and I can now well understand the marvelous progress which Atlanta has made and what is meant when people speak of the "Atlanta Spirit."

In conclusion I wish to emphasize that the year of 1915 holds possibilities for progress in road betterment which we should avail ourselves of, not merely through zeal but through zeal coupled with knowledge. We have had ample opportunity to realize that we need better road legislation, and with so many legislatures in session this coming winter, we shall have the opportunity to accomplish results through revision and constructive road legislation. We have seen what has been accomplished in those sections of country which have utilized in a practical way skilled supervision of road work. We have learned to our bitter cost the danger of allowing our well constructed roads to be left to deteriorate through lack of maintenance, and so we should make the year 1915 conspicuous; not so much through the spending of more money as through the

wise and practical expenditure of the money that will be normally available.

I might add that today you can go on a splendid road from Atlanta to Fredericksburg, Va., within 40 miles of Washington, and by next summer, you will be able to go from Atlanta to Richmond, Washington, Baltimore, Philadelphia, New York, Boston or Montreal on a perfect road, and that road is going to be maintained as such.

THE CHAIRMAN: The Governor, who was obliged to leave a few moments ago, has asked me to call your attention to the reception given by Governor and Mrs. Slaton to-night at 8 o'clock, and to extend you a cordial invitation to be present. I have also been asked to announce that there will be a Woman's Conference on Roads in the ballroom of the Ansley Hotel at 10 o'clock and at 2 o'clock to-morrow, Tuesday. There will be addresses by distinguished women and an illustrated lecture by Mr. J. E. Pennybacker. All women are cordially invited.

Mr. Robert P. Hooper former President of the American Automobile Association will now address us.

MR. HOOPER: I am taking the place of our absent president of the national organization of automobilists, who regretted exceedingly his inability to be present. My previous automobile visit to your hospitable city was during the big tour from New York to Jacksonville via Atlanta. Senator Hoke Smith, then your Governor, easily was the central figure of that tour, and repeatedly in various cities he spoke without hesitation for roads progress, as the head of your State. Now, in the Senate of the United States, he has opportunity to use his great influence in a logical and effective plan of Federal roads participation.

Roads improvement in Georgia is certainly proceeding in a most pronounced manner, and the day is near at hand when it will be just as comfortable to travel by road in Southern territory as is now the case in New England. Here is Fulton County, you have made a wonderful advance in roads construction, and furthermore, you give evidence that it is clear to you that the most used roads must be constructed in such manner as to stand the multiplying and heavier traffic.

You are particularly fortunate in Georgia in having in Governor Slaton another chief executive who is not afraid to set forth quite plainly his good roads beliefs, and I thank him for the unhesitating manner in which he gives deserved credit to the motor-driven vehicle for the large part which it has played in this improvement of the avenues of communication.

In brief, the A. A. A. believes that the Federal government should help the several States on their most important arteries of communi-

cation, and then the States can coöperate more thoroughly with the county and township units in the essential lateral roads.

It was my opportunity to have been the first active chairman of the A. A. A. National Good Roads Board. You will pardon me if I make reference to a speech delivered by me at Springfield, Massachusetts, in September, 1907, at the Goods Roads and Legislative Convention called by that club and possessing the motto of "Good Roads and the Sane Use of Them." In that convention certain speakers went out of their way to belittle the participation of the motorists in highway progress. I confess that I rather impatiently accepted this kind of talk until it came my turn to speak. This, briefly, is what I found myself saying: "I think it is time that someone told of what the autoists have done. The movement for good roads was begun by the bicyclists and has been taken up and advanced by the autoists. Our damage to the roads has been more than offset by the good work we have done in their behalf. I say that it is proper for the autoists to be compelled to obey the law; but we do object to the existing laws. Why should the automobilists pay a tax, when any wagon can draw any load over the same roads? I see no reason why the wagon drivers should not help to support these roads.

Perhaps we motorists at times become unduly optimistic, but I look forward to the day when we shall have highways connecting our several States the equal of those to be found in France. Furthermore, there will be an exchange of road travelers between the North and the South that will be beneficial and educational to both sections of the country. In no way can we become better acquainted than through the intimate channel of roads travel, for then we promptly discover that we are all only human beings, interdependent one upon the other, and equally interested in the general welfare of our great country.

When I came down South on this trip I expected to see before me a lot of men who were walking the streets of Atlanta in sackcloth and ashes. But instead of that, I hear you agreeing to spend money, and I hear you putting up propositions to build more roads. Therefore, we in the North cannot feel that you are as low in pocket as your "Buy a Bale of Cotton" movement would lead people all over the United States to believe. Frankly, I think it is a great mistake for my southern friends to circulate all over the country, this "Buy a Bale of Cotton" movement, indicating that you are financially broke, because you are not. We will give you credit, and we are glad to give you anything you want at any time.

THE CHAIRMAN: I am sorry to announce that the Hon. A. W. Campbell, Deputy Minister of Railways and Canals, Government of Canada, will not be with us this morning. It gives me great pleasure to introduce the Hon. Hoke Smith, United States Senator from Georgia.

SENATOR SMITH: *Mr. Chairman, Ladies and Gentlemen:* The first notice I had that I was expected to address you this morning was when, after breakfast, I read the morning paper, and found that I was on the program. I should have been very much disturbed by the announcement had I not seen the further statement that it was to be a general address, from which I understood that I was not expected to show in any way before you expert road builders, my ignorance of the subject of expert work in the construction of roads, but that I was permitted to talk generally about anything I want to talk about rather than upon technical road building.

I am deeply interested in your gathering and in your work, I agree with my friend who has just taken his seat, that we had rather an overdrawn picture of the great public highway that stretches from here to Fredericksburg, and will soon stretch from Fredericksburg to Canada. I agree with him that it is well paved with good intentions, but unfortunately with nothing else. Now, just a word about the "Buy a Bale of Cotton" movement. I wish to say that if any one came here expecting to see a poverty stricken section, he was vastly mistaken.

MR. HOOPER: I did not say that I did, Senator.

SENATOR SMITH: He has come to the greatest section in natural agricultural resources in the world, and I say that advisedly, and I will prove it with just two or three statements. In this section with proper attention, the soil per acre will produce as much food-stuffs as any soil that can be found anywhere. It begins equal in food producing capacity with any acreage in the world, then it furnishes to our nation a monopoly in the great raw material that must clothe the world.

From whatever section of our common country you may come, you should feel proud of the fact that our United States has a monopoly in the production of the raw material that is necessary to clothe the world.

They can raise in India a very short staple cotton, but they cannot make much out of it unless they mix our American cotton with it. They can raise in Egypt some very long staple and very fine cotton, but it is limited in its use, and it is our cotton, or cotton that is produced in our common country, that is absolutely essential to clothe the world and our cotton crop is growing more and more important every year for this nation. [Applause.]

I am deeply interested in the good roads problem; not exactly in the same way that my friend Mr. Hooper is. He always thinks of a great national highway to run his automobile over, and to have a splendid Glidden tour over. I am in favor of that kind of good roads, but the good road that interests me most is the good road that is to help build up that upon which our country rests for its prosperity more than any thing else. [Applause] Every country, ours

especially, rests for its wealth producing power upon agriculture and manufacture. Agriculture produces something. The mill adds to the value of the raw material by changing it into something of additional value. Commerce handles these products; the railroads transport them, but the wealth producing power of the nation is found in our agriculture and in our mills, and our manufacturing companies must rest upon our agriculture for their raw material as the people of the world must rest upon agriculture for their food. So I place first among the things that should receive the attention of a nation, the agriculture of a nation.

No nation ever lapsed, no nation ever went backwards while making progress in its agriculture. Now our manufacturing enterprises are ahead in world progress as compared to our agriculture. We rank with the best in manufacturing lines, but we are behind in agriculture. We do not produce per acre in agriculture what is produced in other countries. We have not studied agriculture scientifically as agriculture has been studied in other countries. We have not handled our soil with the consciousness of the fact that each year that which we took out of it we must put back with more to increase its strength and power. We have rather, through the richness of our soil, handled it with wastefulness and have each year been disposed to lessen the real resources of our soil rather than to add to it and increase it.

We have neglected the roads in our rural sections; we have left rural life isolated; we have left rural life where facilities to reach the schoolhouse have been lacking, where facility to reach the church has been lacking. We have left it where the people in rural sections oftentimes seek the town rather than live upon the farm because of the lack of opportunity, on account of bad roads, to pass from place to place.

I look upon the good road problem as preëminently a national service. Because it is to lessen the cost of transportation of agricultural products, and the cost of transportation to the farm of that which is needed on the farm, and because it is to take from rural life its isolation and help make rural life all it should be in its beauty and its charm.

I believe we have just begun a great national progress toward the development of the farm. Fifty years ago we established our national agricultural colleges through the Morrrell Bill, giving the landscript in each State to an agricultural college. They struggled along until now in every State, supported by State taxation as well as by the Morrrell landscript fund, we have I think in every State a splendid agricultural college.

Twenty-five years ago, we passed a bill to establish the experiment stations, and for 25 years we have had our agricultural colleges and our experiment stations. Vast stores of knowledge have been gathered in these two institutions, but they have been on cold storage, they have just been there undistributed. You cannot

carry that information to the farm and put it to work simply by circularizing those engaged on the farm.

Within the last 12 months, Congress has passed a bill for agricultural extension work. Starting with the first of this last July, each State received from the national government \$10,000 for this purpose. The appropriation increases year by year until it reaches \$6,000,000, each State beyond the \$10,000 being required to duplicate from its own treasury what it receives from the national government, and all that is known in the experiment stations and the agricultural colleges is to be carried to the farm home and by demonstration on the farm, given for the use of every farmer. In our own country it has been tried to a limited extent. Dr. Knapp was the great leader of farm demonstration work in the United States, but he turned back to Germany for the highest character of work of this kind. Those wonderful people who today are standing off all of Europe, not by their numbers but by their training; those wonderful people 50 years ago realized the necessity of carrying accurate and scientific knowledge in agriculture to the farmer's home, and the Wonderlehrer and Wonderlehrerin, the traveling teacher of Germany, carried to the home of the farmer, through men and women, all of the scientific knowledge of the soil that the college could acquire and the experiment station demonstrate, and gave it with practical illustration alongside the farmer's home, upon the farmer's land, and the Wonderlehrerin of Germany, the woman, traveled from place to place and carried the knowledge of domestic science and of all those things which study and investigation could acquire, and gave it to the German woman on the farm.

Now our agriculture extension bill, passed last February inaugurates for our country a great system of instruction at the home of the farmer by which we expect to see the next 10 years revolutionize the productive strength of the soil of our country, and help to make the farm home more beautiful, more hygienic, more capable of developing splendid men and women, for after all, legislation and work in our country should place commercial progress far behind the problem of developing the men and women of our country.

We have added another measure, last January, a market bill it is called, and starting with the first of July, the Agricultural Department has \$250,000 to be spent this year to organize the farmers for the study of the better preparation and the better marketing of their products, and for the study of the condition of the people in the cities that they may be brought in closer touch with the farmer and be prepared to get the benefit of the better marketing by the farm, to bring consumer and producer closer together, that the enormous economic waste that has been going on may be brought to an end.

Secretary Wilson, who for so many years made this country a great Secretary of Agriculture, said not long ago that for every 50 cents

the farmer got for what he raised, the ultimate consumer paid a dollar, and then he asked "What becomes of the other 50 cents?" An investigation of the question shows that but a small percentage of it goes to transportation and but a small percentage of it really has gone to the middle man; the bulk of it has been an economic waste, and we are seeking and will continue to seek to make a live part of the work of the National Agriculture Department the study of the problem of marketing, that the product of the farm may bring more to the producer and yet go to the ultimate consumer at a less cost than he pays today. That one-half waste can at least, half of it, be saved, and if a fourth of that went to the farmer and a fourth of it went to the consumer, splendid would be the improvement for both.

Then we have added a practical parcels post, progressive and developing, through which we furnish the means for the farmer and the man in the city, the ultimate consumer, to get closer together, and the merchant and the farmer, without waste, to get closer together. Those are three things that have been done for agriculture, another is lacking, it takes a fourth. The fourth is good roads.

Do not allow charming advocates of great national highways to sweep away from your minds the thought that the greatest of all good that can come from good roads is the development of the agriculture of our country.

Nobody likes his automobile better than I do, and nobody enjoys a great national highway or a Glidden tour more than I do, for I rode with our friend Mr. Hooper from New York through to Atlanta on one of those tours. They are splendid, but their chief value is that they may stimulate better roads away from the great highways. If we are to simply have the great highways and nothing more, I would give little for them as an economic force to develop the country, but as an inspiration to build feeders all around, and to have good roads every where, I recognize their value and I am thankful for them. Ah, gentlemen, as we study the people of Europe, as we study, the force and the intelligence that they are wasting in a horrible struggle, as we thank God that we are at peace and ask His blessing to every movement for a world wide peace, we come to the study of our own people, and we come to the greatest problem that confronts a country, the development of men and women; and we are made conscious of the fact that there is no greater duty resting upon any individual than to contribute all he can to the mental and moral growth, to the character building of the great body of the men and women of the United States. And believing as I do that the broadest field for the development of our people is found among those who live in rural sections, and believing as I do that the isolation of rural life has been one of the greatest drawbacks to the development, to the furnishing of an opportunity to our people in rural sections, I congratulate you upon your gathering and I wish you God speed in everything that you may do to help make better roads all over our country.

THE CHAIRMAN: I am going to call now on several good roads enthusiasts for short talks. I will call first on Mr. Leonard Tufts, Chairman of the Executive Committee of the American Highway Association.

MR. TUFTS: *Mr. President, Ladies and Gentlemen:* There is a little mix-up on this question, this through road. Mr. Hooper has my deepest sympathy. After talking with him I find that the route he took is not the route Mr. Page was discussing at all. I went over Mr. Hooper's route some three or four years ago; it rained every day I was on the trip and it took me 16 days to cover about 1000 miles and I was stuck in the mud 16 times; not all in one place, but in many places. So Mr. Hooper has my deepest sympathy. The road that Mr. Page spoke of is not entirely improved. As I believe he told you, only some 28 of the 47 counties have been accepted for maintenance, but the improvement in those counties is very remarkable. In one section in northern North Carolina an excellent road was built some 10 years ago and I went over it last year when we were making these arrangements for the office of public roads to look out for maintenance, and there was no visible sign of its ever having been improved. That all has been brought back again into its original shape and is very good now. What the American Highway Association and the office of public roads are interested in in this through road is simply a demonstration to the people of the system of maintenance and in that it is bound to do a tremendous lot of good. Georgia I understand, has not been accepted as a maintenance proposition except in a few counties.

I came down here some 8 or 9 months ago with Mr. Pennybacker to look over the question of holding the Road Convention in Atlanta and I was never more surprised than when I learned of the change in the streets here. Those of you who are not from Atlanta will be interested to know that it was necessary to re-grade certain streets here and in some places to make deep cuts of some 10 feet and I don't know but what it was perhaps more. Only a small portion of the expense was borne by the city. Most of that work was done by the people who had property on those streets. They made no claims for damages; I understand they all signed off before the grades were made, so that there were no damages paid by the city. Many of the buildings had to be re-built and the expenses were great. It is such coöperation as that that you have here in Atlanta that counts, and it is such coöperation as that, that we expect on our roads throughout the State.

We came here to look after space for exhibits. We were told that we could use this street by the side here; we were told that we could use the space under the viaduct. It seemed absurd to me that a city would give up a street in the heart of the city for exhibition purposes, but it was done and it is that sort of coöperation that counts. Thank you.

THE CHAIRMAN: I will next call on Mr. George W. Cooley, State Highway Engineer of Minnesota.

MR. COOLEY: *Mr. Chairman, Ladies and Gentlemen:* I don't know why I should be called upon at this time unless it is to fill up a little space in the program, because I am really not due until Wednesday afternoon at 2 o'clock, according to contract. If I should talk very much now on the subject to which I will allude in my formal address, it would seem like a waste of time. I am going to touch Wednesday on two special points that have already been outlined here by Mr. Page and other speakers. The question preëminently before us now is the question of maintenance. There is no use in constructing a road, no matter how good or what class of material it is made of, unless some provision is made to maintain it and we have the experience of all our western States, or most of them, and the eastern States, especially in maintaining roads, and I expect to hear from them Wednesday afternoon in the consideration of the paper that I will read at that time.

THE CHAIRMAN: Mr. Sidney Suggs, Chairman of the Oklahoma Highway Commission will please come up to the platform.

MR. SUGGS: Mr. Sargeant-at-arms, I wish you would close that door. I am not in the habit of having men leave the hall when I am speaking. I had an audience of 1500 not long ago, and not one of them left the hall during my three hours' talk. Some of them cried. Some of them said "Damn it." Some of them went to sleep, but there was not one of them left the hall; not one. Did I say who it was I was addressing? Why it was the inmates of the Oklahoma Penitentiary on the subject of the Honor System. So you see they could not leave. I am like my friend here who remarked that this was not his time. I want you to be here though when my time comes, because I am going to tell you how it happened in Oklahoma in my native way, just like I would talk it to Oklahoma people. I am going to tell you that you are not religious people, you are infidels if you are not in favor of good roads, you are absolutely—undesirable citizens. That is the idea. I tell them I can prove it by the Bible and I proceed to do it. It has been some time since I read that portion of the Scriptures, but the way I remember it, it says that any man that will not provide for his family is worse than an infidel. Does that mean to buy them something to wear in the shape of 5 cent muslin, cotton goods, or a little something to eat? I say no, if a man undertakes to raise a family and provide for it, it means not only food and clothing but it means schools, books, music, flowers and it means contentment, what God Almighty intended for his children to have in this world and the man that don't provide those things for his family is not a desirable citizen. Now that is the way I talk to them in Oklahoma

and I make them take it. I tell them that if they have anything to say about it, to look me in the eye and say it while I am here. If they want to criticize me, do it while I am present so that I can defend myself. Don't wait until I get off and say "Well that's a lot of hot air." I tell them to do with what we have, we need not wait for an earthquake, we need not wait for another European war—take advantage of this one. I like the machinery man; I like to meet him; I like to see the fire of business in his eye; I like to talk to him about road building machinery. I like to see the man with the material and get acquainted with his methods, but in Oklahoma, provide the ways and means and there will be no dearth of material and machinery. I tell them down there that when Elias was going through the country and met that widow who had to sell her children to pay the funeral expenses of her dead husband, as was the custom of that day and time, he did not ask her what political pull she had, he did not ask her what her bank account was, he asked her what she had in the house. She told him a few jars and a little oil. He told her what to do with what she had, go into the house, go and borrow jars and not be saving, but to borrow all she could, and that is the first time I remember seeing the word borrow in the Bible; but she went and did what Elias told her, and what was the result? She had plenty of oil for her family; enough to pay her debts and enough to live on for some time afterwards, because she did with what she had. We in Oklahoma have got to do with what we have and make the best of it. I like the way Hoke Smith talked; in some respects I was highly entertained, but I want to say to him and to you all that I believe, my friends, we have got to build the main trunk lines before we build the laterals; at least we have got to start the trunk lines, to set the example. I believe it is as much the government's duty to assist in the building of these roads as to build \$500,000,000 canals; this money belongs to all the people, and we have been waiting, and waiting for the construction of roads. Whenever they start to build those trunk lines, whenever the government becomes interested in those things, the States will become interested, and when the State becomes interested the counties and the townships become interested and we will build up the system, but if the national government waits for the State, and the State waits for the county and the county waits for the township, it will be a waiting outfit, and I am afraid we will wait until some of us go over the range. I want to see something done.

I am a convention fiend, I go to all of them; if I have not got the money to go, I borrow it, because I like to go to a convention and mix and mingle with men that I believe are trying to do some good for the future of the country. I am glad to be with you; I want to get acquainted with all of you. Sometimes down in my State it seems to me I need more friends than I have; I talk roads until they say it is a habit. I went to a hanging one day—I am a newspaper man, I have been in the newspaper business a long time

and am still running the paper, don't have to do anything but look after the payroll, four boys run the paper—but I was at a hanging and there were 5000 people there to witness it and when the Sheriff brought the prisoner out he said, "We are here 15 minutes ahead of time. There is a great crowd of your friends here; if you want to say anything to them, you have 15 minutes to do it." He said, "Yes, I presume they are all my friends or they would not have come here to see me hung, but I have warned them everywhere I could and I don't know that there is anything more I care to say." Then I jumped up and said, "There are 5000 people here and if the gentlemen will yield the time, I would like to tell them a little about good roads," and I asked the gentleman who was going to be hung if he would yield the time. He said, "Well, I think Mr. Suggs ought to be allowed to talk good roads; I understand that's all he does and I am perfectly willing, but Mr. Sheriff, please hang me first." Now gentlemen, I want to meet all of you.

THE CHAIRMAN: We will now adjourn until 2 o'clock this afternoon, at the same place.

November 9, 2 P.M.

MR. GEORGE DIEHL IN THE CHAIR

THE CHAIRMAN: *Ladies and Gentlemen:* The afternoon session is devoted to the subject of Federal Aid, and is in charge of the American Automobile Association. I was asked to introduce the chairman of the afternoon, and it was not my intention to say anything. But after hearing the speech of the eminent and eloquent Senator from this State, wherein he indicated that he had not exactly in his mind the idea of the work that the American Automobile Association is doing, I think a short statement of what the American Automobile Association stands for in the matter of good roads, and why they now have their principal headquarters in Washington might not be amiss.

The A. A. A. believes in Federal aid in highway construction. The A. A. A. believes that within a year or two at the most the Federal Government will make appropriations to assist in constructing important roads. The A. A. A. believes that should be done for several reasons; first that these roads should be paid for in proportion to the benefit received. The construction of these roads not only benefits the farmer, but the inhabitants of the city, as Senator Smith said this morning; and the reduction in the cost of transportation is not only a benefit to the farmer but to the city resident as well, and it is no more than right that the city should help pay for good roads.

For over a hundred years an effort has been made to maintain roads by the expense being borne solely by the locality, and at the end of the hundred years, the roads were not much better than at

the outset. Then the States of Connecticut, New Jersey, Massachusetts and New York enacted laws providing for State aid, and in some of the larger counties laws were passed providing for county aid. The idea of county aid where a county contained a large city was merely an effort to distribute the cost of construction between the rural and urban localities, and in a county where there was a large city, a fair distribution was often obtained by a county aid law. In other places, however, counties contained no large cities and the cities which benefitted from the construction of those roads did not bear the expense; and so came the adoption of State aid laws.

In the richer Eastern States that contain the large cities this provided for an equitable distribution of expense; but the roads which are constructed in the far Western States and the Central States and the Southern States, which bring the wheat and other products to the railroad, where in turn they are brought to the larger cities, these roads benefit to an equal extent, or to a certain extent, the great cities of New York, Chicago, Philadelphia and Boston, and the only way in which those cities can bear their proportion of expense is by enlarging the unit which is taxed for these roads, and that is one of the arguments for Federal aid in highway construction.

Just to give you a little illustration of the difference in the taxable assets of the various States of the Union—the State of Massachusetts has about 20,000 miles of roads and about \$4,000,000,000 of taxable assets; that means \$200,000 of taxable assets for every mile of highway. The State of Nevada has only got \$700 per mile to tax; they have got one three-hundredths part of the taxing ability to build their roads that the State of Massachusetts has. One-half of the States in the Union have got less than \$10,000 per mile; one-half of the States have only a twentieth of the ability of the State of Massachusetts or New York, and it is also on that theory that the government should assist in this burden, as there are many counties in this country which cannot afford to build roads without assistance, and there are also States which need assistance in construction of highways. Therefore, one of the fundamental principles that this Association stands for is that the government should assist in highway construction, also that every political sub-division has a vital duty to perform, and that the township, county, and State each has a duty and that the Federal Government has a duty.

Very often the phrase is used by public speakers and seen in the good roads press, that what we want is good roads from the farm to the railroad station or from the farm to the market, and that we don't want "peacock lanes" across the country for a few motorists; and I am afraid that Senator Smith fell into that error in thinking that the Automobile Association is trying to have roads constructed from ocean to ocean or from the Great Lakes to the Gulf. What we stand for is that the government money should be spent on main market highways and that it should not be spent on lateral or unimportant highways.

The statement has often been made that the construction of roads is a local question, and men oppose county, State, or Federal aid because it is a local question. It is a local question, but it is also a county question, a State question, and a national question. If the farmer starts from his farm with a load of produce for the market, he passes over his own land and the roads on his own land until he reaches a public highway; then he passes over that public highway until he gets to a more important highway, and then passes over that until he reaches a highway which runs through three or four townships and is what might be called a county highway; then he frequently passes over a highway which connects the great centers of population and is a State highway. It must be perfectly evident that the construction and improvement of the road on his own property is purely a personal matter, and that he should keep up the road on his own farm. It is equally apparent that the road which is used only by the people of the township is a purely local question and should be kept up by the township, and that the State and Federal government should not be asked to assist in the construction and maintenance of that road; and that, on the other hand, the county thoroughfare should be cared for by the counties, and that the State should care for the State highways, and that the national government, in turn, should assist in the construction of those roads which necessarily come within the jurisdiction of the national government and are of inter-state importance.

I want to draw your attention to one fact, that this talk of building the road from the farm to the railroad station is something we all agree on; but we believe in starting at the railroad station, because you can readily see the question would arise "A road from what farm?" "Every farm?" Of course, if a road goes from every farm to the railroad station, then every mile of road in the United States will be built; there are 2,000,000 miles of road, and everybody knows that all of the highways cannot be constructed at once. We claim that those roads should be constructed first which carry the greatest volume of the tonnage and accommodate the greatest number of people; that the road should start at the railroad station and work toward the farm, start at the main center of the population and work toward the farm.

The statement is also made that the railroads of the country are the natural highways of the country. It is perfectly true that the railroads do carry and will carry for years the great through traffic; but the local traffic is largely being carried by either electric roads or motor vehicles; in fact in New York State it is not at all uncommon to see delivery wagons 40, 50, and 60 miles from the cities. Consequently we advocate the main roads to be built first, and those are the two fundamental principles that this Association is working for: that the government should aid, and that the government money should be spent only on the main thoroughfares and should not be dissipated by trying to spend it on 2,000,000 miles of road.

We feel confident that real results will be obtained, that the roads the government builds will furnish examples for the various States, and we believe that this work should not of necessity be done by the government, but that the State highway officials, in coöperation with the government, should agree on the roads, the plans, and the specifications, and on the various features of the contract. Then it is only a question of time before those great national roads and the State highways will form the backbone from which will radiate the county roads and the township roads and the whole will be combined into one properly connected and well developed system of highways, which together with the use of motor vehicles, will make for the greatest development this country has ever known.

I did not start to make a speech, but I want to impress these two things on your mind: that the American Automobile Association or the organized motorists of this country are not standing for roads upon which to run a Glidden tour or roads from ocean to ocean, but they do stand for government aid in the construction of highways, and for State, county, and township aid; and we do say that the government money should only be spent on the main roads of this country and that it would be foolish to spend and dissipate it on 2 or 3,000,000 miles of roads.

It is now my pleasure to introduce a gentleman who has been president of the American Automobile Association, is president of the Massachusetts State Automobile Association, and a man who is prominent in the social and business life of the city of Boston and has been well known for years as a sturdy advocate of road construction, Mr. Lewis R. Speare.

Mr. Speare then took the Chair.

THE CHAIRMAN: *Ladies and Gentlemen:* Mr. Diehl informed me that I was only supposed to get up here and say a few words, and give people time to get in here so they could hear the good roads speeches, and the few ideas that I have were covered so admirably that it would sound very foolish for me to attempt to cover them again. As he stated, I come from the State of Massachusetts, where we had the first Highway Commission and the first real organized work on State highways of any State in the Union. We have some good roads, quite a number of them, and when we got down to real work, we built our main highways, and you never find that the Grange or the farmer in our State objects to the policy of the State in building its main highways first. Those highways have been of great benefit to the agricultural work of our Commonwealth. We are not, of course, a large agricultural State, but I heard one member, a lecturer of the Grange on one occasion, give an account of agricultural work in Massachusetts, and he referred to the fact that our State roads had made possible the cultivation of onions throughout the Connecticut valley, to such an extent that the Bermudas had almost been driven out of our markets, and he

gave facts and figures on loads carried over the State roads compared to what had formerly been carried over the old roads. The farmers in the New England States are most enthusiastic over our roads. You must remember that all automobilists do not own high priced cars, but that the great bulk of cars today are those sold at the low prices, and the biggest trade for automobiles is from the farmer—what you might call the farmer interests. This country seems to be divided into about three parts, one-third being real farmers, the second those who call themselves farmers and perhaps are going to farm some day, and the remainder, all those who are looking forward to the time when they can simply farm. All through Massachusetts we had abandoned farms; and, in fact, throughout our New England States we had farm after farm that had been abandoned. Why have they now disappeared from the market? At the present moment you have to pay more for a farm anywhere within fifty miles of Boston than you would if you were to buy an elegant place within eight miles of Boston. The automobile and good roads have brought those farms to the attention of people and they are being occupied and owned as summer homes, and the abandoned farm in the New England States is a thing of the past. You will have to hunt with a fine tooth comb to find any abandoned farms in New England to-day.

I do not propose to take up your time, but I want to emphasize what Mr. Diehl has so admirably covered, that the American Automobile Association is not a pleasure touring organization. The greatest work we have is the Good Roads work and we are working for all the people and for good roads in all parts of our country. We call attention to the fact also that for military purposes this government needs roads. We would be in a sorry plight if we did get into trouble and had no better roads than we have today for moving our troops, etc., and whoever heard of a railroad building its feeders before it built its trunk lines? Now we believe in building the trunk line roads and then building the feeders to their natural sources, and if you get a good road, the farmers who live near that road will take hold, and the whole community will take hold and get a pretty fair road connected with that trunk road, so we do believe that the national government should aid in the building of through inter-state roads, that the States should take hold of the lateral roads, and the counties, cities and towns of the feeders. I have great pleasure in introducing to you at the present time Congressman Borland. He is from Missouri, and therefore he can show us, and I am very glad to have a good audience here to hear him. I have only one request to make, and that is, that on account of the number of ladies who have favored us with their presence today, the gentlemen kindly refrain from smoking.

NATIONAL LEGISLATION FOR GOOD ROADS

BY REPRESENTATIVE WM. P. BORLAND

Of Missouri

The subject of good roads is one upon which city and country are united in a common interest. I have the good fortune to represent a congressional district which contains a city of over a quarter of a million people but which also contains a large and populous rural county. I feel able to speak after considerable personal investigation upon the subject of the absolute identity of interest of the city and country upon this matter. Good roads are beneficial alike to the city and the country. In fact they are vital to the interest of the rural section and of the small town. The city which can depend for transportation upon the great trunk lines of the railroads could very easily get along under present conditions with a purely local system of highways connecting the farm with the nearest railroad station. This system will drain the country of all of its resources, agricultural and financial and will draw to the city like a powerful agent the social and religious life of the small communities.

Those who advocate the system of purely local highways connecting the farm with the nearest railroad station are seeking to perpetuate and strengthen a system which has built up enormous cities by a steady drain of wealth and population from the country districts. Everything in modern industrial life has tended to the aggrandisement of the cities and the destruction of the small town. It would be very easy to build a system of highways under the present enthusiasm for good roads that would have practically the same effect. Such highways would be what are commonly called post roads whose only purpose is to get the produce out of the country district at the earliest possible moment into the big centers. A system of highways can be built however which will do more towards the social, beneficial and industrial upbuilding of the small towns and rural communities than anything else in modern life.

Such a system of highways would open up every section of our country, turn the streams of wealth and population back again to the rural districts, make the small towns again the center of industrial and social activity and check the terrible drain of wealth and population towards the cities.

The time has arrived for coöperation between the State and nation on the subject of road building. I have always been an advocate of federal road legislation because I believe the subject is one of national importance. The rural highway is the first link in the great chain of transportation. Over the rural highway goes annually the food supply of the nation. Every pound of raw material destined for the factories of our land and all of the great export wealth which moves abroad must begin its journey to market over the rural road. No more national subject is before the American

people at this time than that of good roads. It is not sufficient merely to spend money under the attractive title of a road fund. It would be perfectly easy to do this with considerable political success for a few years, but as soon as the people find that they were getting no results for their money a very violent revulsion of feeling would occur which might easily make road legislation a scandal and a reproach. What is needed at this time therefore is not simply to work up an enthusiasm for the expenditure of public money for roads, but to work out a sane and practical system by means of which the roads can be secured at a minimum expense and maintained in passable condition without unreasonable burden on the people. For more than a century we have struggled along under the most clumsy and archaic road system from which a country ever suffered. We have confided the building and maintenance of our public highways to the smallest political sub-division known to our governmental system. This policy of isolated local control was adopted from the English common law at a time when England was a hermit nation with three-fourths of her land in virgin forests which were hiding places for bold bands of outlaws, and at a period in her growth when more than 90 per cent of her educated citizens went to foreign universities for their schooling. We have borrowed that system of local control over the highways born in such an age of English jurisprudence and have retained it long after the mother country has abandoned it. We have tried to adapt it to a great undeveloped country 3000 miles in extent, most of which is removed from the seaboard and even remote from natural water courses. The only wonder is that we have succeeded in developing our country at all under such an expensive and burdensome system. We have expected the little local road district to build and maintain highways without aid in most cases either from the county or the State, and with no aid whatever from the nation, although the duty they were performing was largely a national one and the burden they were assuming was for the direct benefit of the great centers of wealth and commerce. The problem before us now is to equalize the burden of taxation so that the wealth which is drawn from the production of the agricultural regions of the country and centralized in the great cities of the State and nation and in the great export markets of the east, shall be available to carry a portion of the burden of building and maintaining the good roads of the country. The narrow gauge politician will see in this only an attempt to procure money from the public treasury for a particular locality, the broad gauge statesman will see in it the equalization of the burdens of government for the common benefit of the productive forces of the country.

The failure of our present road system is due to many causes, but they are all traceable to the one feature of the isolated local control of the road district. Each little road district is expected to maintain the best highways that it can under the legal powers

which the State chooses to give it, with the taxable wealth that it happens to have at its command and without any scientific or technical knowledge of the subject of road building except what can be picked up by an honest overseer. The result is a patch work of highways on which a large amount of the people's money is spent annually without any permanent improvement. The roads in one road district may be fairly well constructed and maintained because of favorable local conditions. The amount of taxable wealth may be fairly high in proportion to the road mileage: The topography of the country may present few engineering problems: A road material may be easily accessible at reasonable prices. In other road districts upon the same highway the conditions may be adverse. The available amount of taxable wealth may be very small compared with the amount of road mileage to be improved. The topographical conditions may present very serious and expensive engineering problems. The road material may be difficult to obtain within a reasonable distance or at a reasonable price. It frequently happens that the communities which need good roads most are less able to secure them than other communities that need them less. Such a thing as a continuous good road built by purely local efforts is almost an impossibility. It may be said, why do we need a continuous good road. Why will not disjointed fragments of roads do just as well? If roads are looked upon solely as an accessory to the nearest railroad station a few fragments of disjointed sections of roads would do just as well as continuous good roads, but if roads are looked upon as a means of opening up and developing the country, raising land values and improving the social, intellectual and religious life of the rural community, then it is necessary that the roads go somewhere and be connected up into a system of county, State and national highways.

Most nations, have approached the road problem wholly from the point of military necessity. The great highways of antiquity were military roads built to enable the power entrenched in an imperial capital to send its legions speedily against distant provinces for the purpose of either putting down insurrections or collecting tribute. This was the purpose of the great imperial highways of the Romans. In modern life, however, roads are not built for pillage and conquest but for civilization and trade.

Every great nation that has successfully built and maintained a system of highways had found it necessary to classify its highways according to the demands of the traffic. It will be impossible for our country to solve the road problem without some sane classification founded upon common sense. One of the great defects of our system has been to place all rural highways in the same class. If one road happens to be improved better than another it was due entirely to the happy accident of the local situation or local enterprise and not due to any general plan for better means of communication. Modern scientific study shows that under any condition

80 per cent of the traffic will go over 15 per cent of the roads. This is true even in the most primitive conditions and where the roads have no improvements whatever. It is not only unnecessary but it is extremely wasteful to attempt to improve the entire system of highways upon the same basis. It is equally wasteful to attempt to distribute federal money among the highways upon the accidental circumstances of the way in which they happen to be improved at the present time. My county in Missouri has over 300 miles of highly improved rock roads because the taxing power is ample and local conditions are favorable. More than 100 counties in Missouri have not a single mile of rock road and yet the public need for permanent roads in those counties from the standpoint of the productive energies of the nation is just as great. If federal money is distributed wholly upon the basis of the present condition of the roads, those counties that happen to be fortunate in having rock roads at this time will get the bulk of the money while those that are unfortunate and have not been able to secure rock roads will get very little if any. I know of no justification of this system of distribution of the federal money except the Biblical injunction, "Unto him that hath shall be given, and unto him that hath not shall be taken away even what he has." I have always supposed however, that this statement in the Bible applied entirely to spiritual matters and was not a rule of justice as to public taxation.

It will be necessary in my judgment to classify all existing highways into at least three classifications. The first is the great cross State or interstate highways reaching into every county in the State and opening up every section to the benefits of the improved land values, freer social intercourse and higher intellectual life. The second is the main feeders or great country roads, and third, the by-roads, local roads or lands. These various classes of roads should be built, improved and maintained with a view to the amount of traffic that they can bear and must bear. The first class should be of the most permanent and scientific construction. The second class could be of a less expensive nature and would need less maintenance. The third class could be improved only to the extent that the community required. The expense of building and maintaining these roads should be distributed upon the same basis. The roads of the first class should be supported by the taxing power of a large area of country including at least the entire State, because the wealth gathered in the cities ought to contribute to them. The second class of roads should also have a wide taxing power at least co-extensive with the county and possibly with a group of counties or with some State aid. This would leave the small road district or local community only the burden of the smaller or purely local roads. However much politicians may twist and turn and argue about the question we must eventually come to some scientific solution of the problem. I realize that when we begin to talk about real road improvement political difficulties of all kinds are encoun-

tered. It is easy enough to shout of good roads and to convey the adroit impression on the minds of every hill farmer that he will have the road pass his place; but when we get down to practical business we will find that only a very limited percentage can ever be improved to a high condition and that these roads must be the ones which will serve the greatest number of people. It is very easy to defeat the whole plan by appeals to the prejudices of those voters who would be led to believe that they will get no direct benefit from the roads. It is possible even to inflame them to high indignation against the people whom they think will be benefited. This is true even though the total expense for a system of roads will not be a cent more than the present expense for a bad system of roads. What the people will demand in the next few years in this country is good roads and no politics.

It is a fatal mistake to mix politics with the good road question. In the legislation enacted by Congress, it is my judgment that provision should be made for a practical and scientific classification of roads, not on the basis of the present accident of their construction but on the basis of their need for future development. It is necessary also that provision be made for the maintenance of roads after they are built. It is useless and expensive to build good roads unless some provision is made to maintain them and roads ought not to be built faster than they can be properly maintained. It will be necessary in the third place to provide for a system of State Highway Commissions which shall be in direct touch with the Office of Good Roads of the Department of Agriculture of the U. S. Government so that the most advanced, scientific and economical methods of road engineering, construction and maintenance may be at the service of all of the roads of the country, even down to the smallest by-road or lane.

I have proposed legislation in Congress embodying those ideas and I am glad to say that these proposals have met with the approval of the real friends of good roads all over the country. I have no pride of opinion as to the details of the plan nor have I any pride of authorship. I am willing that the cause of good roads should be advanced by any method and through any channel that will be of service, but in my judgment it is time for the politician to quit shouting good roads and get down to some practical benefit for the people.

THE CHAIRMAN: Four years ago we had a good roads congress at St. Louis and at that time things did not look as promising as they do today and I certainly congratulate this country on the movement brought forward in such a short time. If it keeps on at the same rate, we certainly will have good roads in this country. At that convention there were a lot of men who came down there to get information. I suppose that is what a great many of you are here for, and when they got up and told us how to build roads that cost

\$35,000 a mile, they did not, some of them, seem very much interested, they said, "We have about \$35,000 to spend in the State to say nothing of a mile, and we want to know how to build roads without this enormous expenditure." They got down to \$6,000, but that did not interest some of them very much. There was a gentleman present at that meeting who had charge of the expenditure of some \$50,000,000 in the State of New York, and was doing some great work. He gave us this theory in regard to road maintenance; I can remember very well some points he made four years ago at that meeting. A road commences to deteriorate the day it is opened, and from that day they must commence to repair it. No road should be open to the public until they are ready to repair it; that was his theory. In the light of later events, that same gentleman went to the State of New Hampshire where they perhaps had as many dollars as they had millions to expend in the State of New York and in a conversation I had with the then Governor of New Hampshire, I said, "You have got one of the greatest road makers in the country, but what in the world do you suppose he is going to do up in your State without any money?" "That man has been handling \$50,000,000 and it was only a question how fast he could spend it without wasting it, and now he is coming up to New Hampshire and the Lord only knows whether they are going to give him any appropriation next year or not." And as I had to travel over those roads, I was personally interested to see what he would do. I did not know what his theory was. I have not seen him until today since I bade him goodbye in St. Louis, but I have seen his work, and the first thing it seemed to me he did was to repair his State roads which were already in existence and were wearing out or worn out and he did not seem at all in a hurry in building any more roads. What he has accomplished with a small amount of money at his command in New Hampshire is something wonderful, and I believe that information from him as to how he can build such high grade roads with such a small amount of money would be more interesting than how you can build a brick or concrete boulevard at \$35,000 a mile. I refer to Mr. S. Percy Hooker, State Superintendent of Highways of New Hampshire, and I take very great pleasure in introducing him.

MR. HOOKER: *Mr. Chairman, Ladies and Gentlemen:* I could not ask a greater compliment than to be credited with the ability to build something out of nothing. I have not been able, however, to get quite that far. There was one point the Congressman made when he said he did not believe there was any man who understood the road situation at all that thought there was any possibility of maintaining a road without building it properly. Well, he picked the one man then, because I do, to a large extent, I think we are going too fast. When I go over the entire United States and see what's got to be done to make passable roads, to make roads that

you can go over, I do not believe that we are following the right line in endeavoring to build all that mileage as we now talk of constructing roads. I don't think it is possible. It does not seem to me it is possible. I went in to New Hampshire with a small contribution and a large road mileage. New Hampshire is largely a tourist State, a State where it was necessary not to have short roads from the farm to the station, but to have roads so that you could travel from the Massachusetts line to the Canadian line and from Vermont across to Maine, and we had hardly any money. With that in my mind I turned around, turned a complete somersault. I made up my mind that it was not possible for us to talk about concrete or brick roads and get anywhere, that our situation was not as much an engineer's proposition as it was a common sense proposition, of getting the worth of our money and maintaining the roads that we should put in condition. Well, of course, there is one thing we had to start with; you have got to start with the drainage of the State road. It does not make any difference if I am going to put on a brick surface at a cost of \$22,000 a mile or take the natural sand clay where the surface only comes to \$1500 a mile. I build the road in its foundation, in its drainage exactly the same, because that is where my road is going to pieces. With that value, that thought in mind, we constructed, the last three years, the roads in the State of New Hampshire. We find that they are pretty generally satisfactory to the people that go over them. They say, "You have good roads." My average cost is only about a quarter of what it is in the other States, and as I say, my drainage is just as good. My theory is that if you will attend to the drainage, if you will attend to your grades on your roads, it don't make such an awful lot of difference what you put on for your surfacing. I don't see many material men here; they are all in the other part, they will all deny this proposition and say how foolish it is, but when we can build a road at a cost of \$150 to \$200 a mile, we keep that road through the entire season so it is good enough to drive over, so nobody kicks about the condition of your road, so it will never mire a team or stop an automobile. I think we have a different idea from the ordinary idea, and an idea that a good many of you fellows have to follow out. Now this Road Congress I assume is not for this purpose. I don't know why I was asked to talk today. I have a technical paper on surfacing roads, but I was just asked to get up here and fill the gap because somebody had gone and they knew I was a crank and an enthusiast and would be glad to tell you what I think about the way you have to build roads. Before you can run you have to walk, and when I come down from Washington over the railroad and see the road you now have through this entire section of the country, I don't believe you want brick roads or concrete roads as much as you want more intelligent work in taking care of the drainage and building up the preliminary of your present roads. We are liable to go too far. They come down out of their

pockets in good shape now, in my State, but I have only half a million to spend in half a year; I have between 1100 and 1200 miles of road to keep in condition so you can drive over it at any period of the year without any inconvenience or trouble, and people pat me on the back and say, "How well you are doing." I can take that money and build 20 miles of brick road, but how far would that go? You have got to divide it equitably. It is well enough to say, as the Congressman did, we will take them in order, but you are not going to do it as long as the people in Washington are paying for it. You have got to divide those roads up and the money will be spread out so thin with that class of roads that a lot of you won't see it, it won't get to your county. Now, talking not as a road commissioner but as a Yankee, I believe we have got to spread that money so that the fellows living in the country will see something you are doing and be willing to stand back of you. Perhaps you can point out a road and say, "That is not as good as a concrete or brick road, but you can go clear across the county on it." When a man is starting across the county, if he can go through that county on a road that you can guarantee to him is properly drained, it is pretty good to drive over and he can go clear across the county on it, he will like it a good deal better than to go one-eighth of a mile in this direction at \$25,000 a mile, and you won't get many advocates of the building of that sort of a road until you have educated them up to it. My theory is that my road shall be just as good so that the State or county or locality can at any time put on that the surfacing they are able to pay for. You will have the essentials and from that you will educate whatever locality it is, much easier to the proposition of putting on that other surfacing. You will all of you get proud and chesty some day and say, "They have got it over in that other county and we will put on the best surfacing." You will be a great deal more apt to do it if you will get a pretty good road there than if you started very many of the roads I have seen coming down in the country. A man way up in New Hampshire has no business to come down in Georgia and tell you what you can do here. A road proposition is just as much a special feature as a man's suit of clothes is, you have got to cut the road to fit the case, but I am pleading for us meek and lowly ones that cannot go in for the best work and can't build the expensive roads, and yet I want you to feel that you have a future if you will start, if you will take the essentials of this road and build it up, show that you have started and people will back it up to a far greater extent than you dream of now. I don't know why I am here today, I have another paper to take up and had no idea of speaking in any way except to plead for the meek and the lowly—there's a lot of us in the country. Then the Congressman was talking about his Ford car; I go about 40,000 miles a year in a Ford car. They told me I would have Bright's disease if I rode in that car, but I have done pretty well so far and don't see that I have gotten more humps

in my back than I would have if I had ridden in a Pierce-Arrow or a Packard. There are lots of us; there are some plutocrats but they are the favored ones and the rest of us have got to go as we can and I contend it is much easier for me to go around in a Ford car than on my feet; I am sure I would have corns if I had tried to cover 30,000 or 40,000 miles on my feet; and I think in most instances you will find people generally, when you begin the road movement, if I say I guess it will cost us \$12,000 or \$15,000 a mile you will find lots of people that will have cold feet, but if I show them a road that they can get over, show them a road on which a man can carry as big a bale of cotton or as many bushels of wheat as on the other road and tell them it is not going to cost you any more a year to do it, you will interest them quicker and I believe that in a way we are on the wrong end of the game, we ought to take the fellow where you have not any roads and show him the best you can do for a small sum of money rather than show him the best you can do for a big sum of money. I have just seen a distinguished advocate of brick roads here and I wish he had been in here a minute earlier so I could show him how it figured out. It would cost \$700 or \$800 a mile interest charges. I think I happened to be one of the first highway commissioners that put in a brick road as a highway proposition, but I don't see how that is going to help a man out in Oklahoma at present. I think you have got to tell him, "Improve your road to the best of your ability with the money you have and you will find a gain in that whether you have the best road or not." I thank you gentlemen.

THE CHAIRMAN: Gentlemen, I have heard from the North and a section of the country where the State finds it necessary to build roads at a low price. The crying need of this country today is how to build roads at a low price. The next gentleman I will call upon is from the South. He has made this road problem a study. I have the pleasure of introducing to you Dr. Joseph Hyde Pratt, State Geologist of North Carolina.

DR. PRATT: This afternoon I feel a little bit like the man who goes to a banquet and just as he is sitting down at the table the toastmaster whispers to him, "I am going to call on you later for a toast." When I have been in that predicament it has very often nearly ruined my appetite for the good things on the table. I am in somewhat the same position this afternoon. When I came onto the platform, Mr. Diehl stated that I would be called upon this afternoon to take part in the discussion of this question of national aid, and I have had to busy myself while these others were talking to make up my mind what I was going to say, instead of enjoying to the fullest extent the splendid things said thus far in regard to national aid and the general question of road work. I was extremely interested in what Mr. Hooker said, although it did not deal di-

rectly with the question of Federal aid, yet it does have a close bearing upon my idea of Federal or national aid. I am very much in favor of national aid, and I do not believe there are very many men in Congress or out of Congress that are not in favor of some form of Federal aid in the construction of roads throughout this country. I have forgotten how many bills have been introduced into Congress in regard to this question of Federal aid. Thus far none of them have been successful in passing both branches of Congress. Some of them have passed one branch and been tabled or defeated in the other, and vice versa. It does indicate that the question of Federal aid is gaining strength day by day, and to my mind it is simply a question of a short time when some Federal aid bill will be passed by Congress. Now I suppose in the discussion it is expected that the speaker will give to a certain extent his ideas as to what he believes is a practical form of Federal or national aid. I wish first to discuss a few ideas that Mr. Hooker brought out that especially appealed to me. First, that the surfacing material of a road shall be dependent upon the traffic that goes over that road. Now you may need in New York State, in certain sections and similarly in Ohio and other States, a concrete or vitrified brick road that costs anywhere from \$12,000 to \$15,000 or even \$18,000 per mile, but do we need it in my State (North Carolina) where the traffic is probably one-tenth or one-twentieth of what it is in those States I have mentioned where they do need an extremely hard surfaced road?

Would it not be much better to put in a surface that is satisfactory to the traffic that is now going over the road and what may be expected in the next five years, so that instead of the road costing \$12,000 to \$18,000 a mile, it can be put in at a cost of \$1500 to \$2500 a mile, and yet give perfect satisfaction as regards the traffic that goes over it, *provided* that the original road bed has been so located and drained, that there will never be any question after the highway has been built of re-locating it? They put on any surfacing material you may wish, if your traffic is such that you can put a sand-clay or gravel surface or a top soil surface on at a cost running anywhere in the various counties of North Carolina from \$500 to \$2500 a mile and satisfy the traffic, is not that the best surface to use? There is no pavement you can put down today, I don't care what it is, that doesn't have to be maintained. It is necessary, right from the minute the pavement is built or the surfacing material put down, to provide a maintenance fund with which to constantly repair the surface of the road. For years with us the sand clay, gravel or top soil surface is going to be perfectly satisfactory as regards the traffic that goes over the road. As the traffic increases it means one thing—that the county is becoming more thickly populated, has greater wealth, and that the road revenue or the amount that will be raised by taxes for road purposes is constantly increasing. As the traffic increases and

finally becomes so great that the present surfacing material is not satisfactory, then you are financially ready and able to put in a harder surfacing material; you have not lost anything; and yet you have had the use of the cheaper surfacing material over a large mileage for a series of years. We have a splendid foundation for any kind of surfacing material, the grading and draining is all finished, and we simply come back and put down the surface the traffic demands. If it is vitrified brick, you have one of the very best foundations on which to put your vitrified brick pavement, and it is the same way if we decide to put in some form of bituminous macadam.

We come now to the question of national aid. I believe in national aid; I believe it is a function of the Federal Government to assist us in developing our counties and States. I believe that public roads are public necessities and that it is as much the function of the Federal Government to assist us as it is for the States to assist the counties and townships. I do not believe it is feasible in framing such a bill to say that the Federal Government shall build the same type of road in all parts of the United States, that it shall build a vitrified brick or cement road and that such roads shall be built in every State. North Carolina had much rather, if there is going to be a certain amount of money appropriated with which to build roads in North Carolina, that they locate the road, properly grade it and drain it and then surface it with such materials as will be satisfactory to the traffic that is going over that road in North Carolina. A road does not need the same surfacing in North Carolina as in New York State where you have 1000, 1500 or perhaps 2000 automobiles over each mile of road per day, where in North Carolina we have 100 to 200 automobiles going over each mile of road per day. We get more mileage and get just as satisfactory a road. I don't believe, in connection with Federal appropriations for road work, that they should be used in any way in the question of maintenance of roads built by the State. I believe they should be used in building the main highways, and I further believe that the Federal Government should build these roads and that the States should have nothing to do in regard to their construction; but if the government builds so many miles of road in a State, it should be obligatory on the State to build a certain number of State roads, or roads leading into the highway that the government itself shall build; on the same plan that if you build a State road in most States, it is obligatory on the counties that they build so many miles of county roads leading in to the main State roads. Now the question has been raised that in any Federal appropriation for road construction, it would always be apportioned or tried to be apportioned the same as other appropriations so that each Congressman would be able to get a little for his Congressional District. If you could see road money spent, Federal, State, or county, in the way I think

it ought to be spent, it would create and build up a citizenship of the most unselfish people, because I believe that money for road work should be spent in such a way as to insure the road being built and located where it will serve the best interests of the county, State or nation according as it is a county, State or national highway. I want to illustrate that. I have been advocating in North Carolina State aid. As yet we have not got what we want; but we have got certain State convicts at work on the roads. The first road the State agreed to build was across a portion of Henderson County in Western North Carolina. The extreme northeastern portion of this county is a jog between two other counties, Buncombe and Rutherford, which wished to be connected by a good road. As far as Henderson County was concerned, the building of this road across the jog of the county would be of little or no actual value to the county itself. The township containing this part of the county could not afford to build the road. There was seven miles across Henderson County that was needed to be built to complete a State road from Charlotte to Asheville. I advocated the State's building this seven-mile link, arguing that the county could not afford to build it; that it was a road that the State needs and that the State can't build a mile of road anywhere in North Carolina on a through highway that is not a great benefit to the State as a whole. You cannot build a road anywhere in the United States that is not of some benefit to the United States as a whole. The public roads belong to the people of a State. They belong to the people of the United States; every single man, woman and child has a right to go on any mile of public road that may exist in this country, and if we can ever make up our minds that we will be willing to put into the hands of the Commission, that the Federal Government undoubtedly will appoint, and let them decide where the Federal money shall be spent, I, for one, will be perfectly satisfied that in the end North Carolina will get her part of whatever Federal appropriation may be made; she may not get it this year or next year, but you will in the end see North Carolina getting her proportional part of any Federal appropriation that may be made for Federal roads. In Orange County we carried a bond issue of \$250,000 against great opposition, the Road Commission was appointed and the question of location of the roads was left to this Commission. A man in the northern part of the county did his best to defeat the bond issue. It happened that one of the new roads was built right by his farm and he now says: "If there is any talk of an additional bond issue or the county wants to raise any more money to build roads in Orange County, I will go out and work my best to carry that bond issue; a road has gone by my house and I realize what good roads mean and want to see the rest of the people get the benefit of them." If we put the question of where the money shall be spent into the hands of a competent Commission, I believe we can leave it to them and in the end get the best results and we won't have a little piece of

good road here and another piece there and another there and perhaps none of any particular importance as interstate or intercounty roads, and all brought about because some Congressman wanted to bring so much money into his district. I do not believe in Federal appropriations for maintenance of post roads or appropriating so much for each mile of macadam or sand clay or dirt road. I believe in spending Federal money in the construction of roads. In State or county bond issues, I believe that just as much of that money should be spent in connection with the grading and draining of the roads and just as small a percentage as possible in the surfacing of those roads. The grading or location is what you might call the permanent part of the road, and I want to see the Federal money spent on a permanent road, not on patch work to repair a mudhole here or cut down a grade there, but I want to see permanent, main highways located and built through this country. Thank you.

THE CHAIRMAN: It gives me great pleasure to introduce to you a gentleman who, for over 20 years, made an interesting study of this good roads movement, Mr. Clarence Kenyon, President of the Indiana Good Roads Association.

MR. KENYON: *Mr. Chairman and Gentlemen:* I think that you are all interested in this question of national aid. I congratulate you on having listened to not only an eloquent but a convincing argument in favor of national aid by Mr. Borland of Missouri here. It seemed to me that that argument would convince anyone of the necessity and the usefulness of Federal aid in the construction of main, interstate highways. I want to talk a few minutes about the practical side of this proposition. Just to sit here and listen, and generally think about good roads don't produce results. What has been done? What is going to be done, and what are you going to do to help the cause? It's the important thing. Just to listen to an argument, or read a story in a paper, may give you a nice mental reaction, as President Wilson says, but it don't cause you to do anything, it does not make such a conviction in your mind that you get out and hustle for it. I had a queer experience a short time ago. I was going by auto from Chicago to Indianapolis, where I live. A highway superintendent stopped me and said, "I want you to be sure, in going down, to note a certain bit of road." So when I came to that place I was looking at the road which was pretty well furrowed, when I saw a farmer, that classed himself as a hayseed, and thought he was pretty smart, as I found out afterwards, call his boy. I was going very slow and stopped. The little fellow ran out behind the automobile to catch the number and where it was from. Well I saw this operation, although I was part of the time looking at the road. I went in to see him and said, "Why did you send that boy out to catch the number on my machine? Have I been violating the law?" He said, "No; come in. How would

you folks like to have a glass of milk? Johnnie, go and get a pitcher of milk and take it out and give the ladies a glass of milk. I will tell you why that was. Look at that road. I was taxed, and am being taxed for 10 years to come for building that road and it has been down only a little over two years, and look at it." "Well," I said, "what about it?" "Well," he said, "it is nearly worn out already." I says "Well, how can I help it?" He said, "I have been sitting here on my porch day after day counting and looking at the vehicles that go by," and he brought out a little pad of paper where he had been keeping tab on traffic on that road. He says, "Here was yesterday, there were 105 automobiles passed, and not one single one of that 105 had an Indiana mark on it; they were all Illinois, Ohio, New York, or some other State." And he said, "I sent my boy out today, because I could not catch what was on your car, to see where you are from and where you live." I said, "Mine is Indiana and I live in Indianapolis." "But you don't live in my township and my county, you don't pay any part of the cost, and yet you are wearing out the road and tearing it up. I want to know about it." I said, "What is your theory?" "Well," he said, "I don't know of any way of taxing the people over in Illinois and New York, that go through here to Chicago, Cleveland, South Bend, and other places, in troops unless we have the Federal Government pay part of the cost of building these roads that they are wearing out." I said, "I agree with you that far." And he said, "I don't see any reason why you people down in Indianapolis should not help pay, if you come up here and use this road, too. We are willing to pay our share of the cost, but you are asking us now, under the State law, to pay the whole cost, and spread it over ten years, and this road has only been down two years and is nearly worn out now." I said, "That is a splendid argument for Federal and State aid, and I agree with you about it, but what have you done outside of keeping a tab on the traffic and cussing me, and the other fellows, and things generally, because your road is being worn out? Have you said anything to your Congressman about it? Have you gone to him before election and said, 'I want to know what your position on this national aid question is?'" "Well, no I had not thought of that." I said, "that's the reason why Federal aid is not any further along than it is, because you are talking about it, and swearing about it around at the corner grocery, or here on your own porch or out at road conventions, where you get with a few road enthusiasts that agree about it, and you don't go after the fellow that has the say so about it." He said, "Right you are; the first time I see my Congressman I will say a few things to him, by gum." That's what is the matter with us. We get a sort of academic interest in this thing, but we have such a lot of interests of our own that we won't consecrate a little bit of time to push the cause in a place where it is effective, because it is some trouble, and we can't get away from our business, and it is a little out of the

way, and we don't like to write letters, etc. The Congressman might throw them in the waste basket, and so forth and so on. We are not going to get results until the people get an understanding of the question and think it so strongly, that they will go after the man who has got the say so about it. This farmer said to me—"What made you in favor of the government helping to pay for roads?" "Well," I said, "the government builds the Panama Canal costing \$400,000,000, many thousands of miles away from here and pays for it out of public funds. It is just a transportation system, and Uncle Sam goes down to Porto Rico and builds miles and miles of roads, and pays for them out of the general treasury and we don't kick at all, we don't shake our fists at the Congressman about that. Then he goes up to Alaska and builds not only miles and miles of highways, but in this last Congress, this Democratic Congress, led by the Democratic President—they have appropriated \$35,000,000 for building a railroad, up there, a long way from us, and who is paying for it? We are. You are. You don't kick about it. Congress goes on and does it, and yet, the same amount of money that went to build the Panama Canal, invested in roads in this country, would be of more material benefit to the home people of this country than three Panama Canals. Yet you don't say a word about it. Again we go over to the Philippines and say, "Do you need roads over here?" "Yes." "Here is the money, we will pay for them." We go out to Hawaii; oh, yes the Federal Government will pay for the roads, but if they need roads in Georgia and Indiana and Ohio and Missouri, oh, no, let the people build their own roads. There is your proposition, and yet you don't put it right in your fist, and go and shake it under the nose of your Congressman and say, "I want you to understand if you are not in favor of a little Federal aid for our highways, I am not in favor of you." When the voters get to doing that, Congress will do something, and then you will get somewhere and not till then. Now, just a word more; Congress has heard, and is trying to do something, but politics must be in it. Along comes one man and introduces a bill in Congress for a \$25,000,000 appropriation and he says, "Here, for every mile of post road in your county, that is an earth road over which the mail is carried, we will pay \$10 a mile, and pay it to the county or to the township—just hand it out to you, and we will not ask any questions about how it is spent, we will just hand it out. If it is a gravel road, we will give you \$15 a mile, and if it is a macadam road, \$20 or \$25 a mile and this money will go into every Congressional District, every place will get part of it. See what we are doing for the people. We are not going to ask you how it is spent, but you will get it." Now that was one plan, and the House passed that bill by an overwhelming majority. The money was to be spent under no supervision, in no particular place, but just everywhere. Well, when people commenced to think about it a little bit they said, "That's just a pork barrel measure;

when you spread \$25,000,000 over 1,200,000 miles of road, what is it going to do? Why, it is such a small amount that it will do no good, and by the time you give it into the hands of 150,000 officials to expend, what would become of it and who is going to make a report about it?" And so a lot of pretty sensible men, as it seemed to me, opposed the bill, and when it got over to the Senate, they had heard from the country, and said no! Now, that is one plan; bear that in mind. The Chairman of the House Committee on Roads is obsessed with the idea that that is the way to do it, that that is going to solve the problem. Come to the next plan. "If the government expends say \$25,000,000 and it is apportioned on some fair basis among the States, why the States must expend an equal amount, and the States can raise the money as they choose, by bond issue or otherwise, and that fund will be spent under the direction of a State Highway Department." Well, here's a lot of States that have no Highway Department, and they would not get any of the fund; again there are 19 States that have no power, under their constitution, to issue bonds for that purpose and they would not participate in it. Well, I don't know, that's a pretty tough proposition, where are we at on it? So there was another difficulty, that was urged as a reason why nothing should be done, instead of putting it up to them, and saying "then for God's sake to find a way to do it," the plan as proposed was merely argued down or in abeyance. There is still another plan, that is proposed, namely: that the nation should appropriate a certain amount of money for roads and then have a National Roads Commission and put the money into the hands of that Commission to build, as Dr. Pratt and some others of these gentlemen said, a system of national highways, not all at once, but build them gradually as they are needed, where the traffic goes and where the necessities of the nation require. Is not that practical? If that is not practical, and the other is not and the township plan of sending it out to our rural routes is not, is it not their business as legislators to solve that problem the same as they solved the money question? The way to resume, is to resume. Are they doing anything about really solving it? Not a thing. The good roads people have to go down to Washington every session and urge them to do something. Why? Because the people don't go up to their noses with their fists and say, "If you don't take a little more interest in this road question that affects every man, woman and child in this country, that affects the cost of their living, their social relations, and all that will make this nation better and greater, we are going to do something to you," and then you can bet there will be some response on this road question, and it won't be until then. Some say too, "If we build national roads, they will be nothing but roads for joy riders and automobiles." I will tell you a little experience I had about that. I went up into Marshall County, one of the northern counties of our State, at the request of someone to make a good roads speech, it was in the evening and in a little town between 500 and 1000 inhabit-

ants and I was quite surprised to find 100 or so people there, and I referred to the fact that some people, especially farmers, have a sort of prejudice against automobiles, and I made such argument as I could, that that prejudice ought not to be because it did not make any difference if an automobile did use the road, it did not prevent the farmers from using it, it was just like a railroad, because the King goes over it, or the President goes over it, or someone with a special train goes over it filled with champagne, well dressed ladies, and a lot of jolly fellows, that don't keep the farmer's corn and cotton and potatoes and other things from going over that same road. At any rate, when I got through, there was a farmer with three or four of his neighbors came up and said, "I wanted to talk with you a little about that speech you just made. Your remark about the prejudice that the farmers had against the automobile. Now I will admit we used to have some considerable prejudice against the automobile, but if you would go around a little bit now, you'd find that that is dying out pretty fast." He continued, "I live out in the country, 8 miles from here and these are my neighbors; and I have got a cheap car, and when we heard you were going to make a speech about roads, we thought we would come in and hear you, even though it was cold and the roads were muddy, but let me tell you one thing, Mister, if we had had to drive a team in here to-night, 8 miles and back, to hear you, if you had been the President we would not have come. Farmers have found out the convenience of automobiles just as well as you city fellows and you might just as well get next to that idea, too." I was out in Kansas a short time ago, in Barton County, I said, "How about the automobile prejudice out here?" A fellow says, "Go on; there are 18,000 automobiles here." I said, "What?" He said, "Yes, there are automobiles enough to carry every man, woman and child out of this county in one day. All you need to do is to go to the county fair, and you will see whether or not the farmers have automobiles." That's the idea. Remember that Federal aid can only be obtained, and your State aid obtained by getting next to the legislators, and going after them.

THE CHAIRMAN: Gentlemen, Dr. Pratt has some announcements to make.

DR. PRATT: Mr. Winn has asked me to call your attention to the reception by the Governor at the State Capitol from eight to ten-thirty this evening, and also that delegates desiring to take the trip over the Fulton County roads will please register at the Information Bureau. The Committee has prepared a little folder which gives a description of the itinerary and various points of interest on the route.

THE CHAIRMAN: Gentlemen, the meeting will stand adjourned until ten o'clock tomorrow morning.

November 10, 10 a.m.

PRESIDENT FLETCHER IN THE CHAIR

THE CHAIRMAN: I want to call attention again to the Women's Conference at the Hotel Ansley, at ten o'clock this morning and two this afternoon. All ladies are invited to attend. I also want to call attention to the fact that the annual meeting of the Highway Association will be held on Thursday at 8 p.m. in this room, instead of Friday as announced in the program.

I have the pleasure of announcing the appointment of the following Committee on Resolutions, which will meet at the call of the Chairman.

COMMITTEE ON RESOLUTIONS

Chairman, W. Tom Winn, Commissioner of Fulton County, Georgia.

William R. Roy, State Highway Commissioner of Washington.

George C. Diehl, Chairman, Good Roads Board, American Automobile Association.

Charles J. Bennett, State Highway Commissioner of Connecticut.

H. J. Kuelling, County Engineer of Milwaukee County, Wis.

W. D. Sohler, Chairman, Massachusetts State Highway Commission.

Henry W. Durham, Chief Engineer of Highways, Manhattan, N. Y.

Frank F. Rogers, State Highway Commissioner of Michigan.

C. A. Kenyon, Indianapolis, Ind.

W. S. Gearhart, State Highway Engineer of Kansas.

E. R. Morgan, State Road Engineer of Utah.

James R. Marker, State Highway Commissioner of Ohio.

Major Amos A. Fries, Corps of Engineers U. S. Army.

J. W. Hunter, Deputy Highway Commissioner of Pennsylvania.

Prof. E. J. McCaustland, Dean of Engineering, University of Missouri.

The first matter on the program this morning will be a report by Mr. A. N. Johnson of the Bureau of Municipal Research, New York City.

MR. JOHNSON: *Mr. President, Ladies and Gentlemen:* The Chairman of this Committee, Mr. Wadhams, is unable to be here, so I have been asked to present the report of your Committee on State Legislation.

Your committee on "State Legislation" begs to submit the following report of its work:

It was first necessary that a compilation of all the State road laws should be made. This was seen to be so large a task that unless it was possible to get some assistance the committee could

not undertake it. The matter was therefore taken up with Mr. W. L. Page, Director of the U. S. Office of Public Roads, and the purpose of the work explained to him. He advised the committee that he would have his office undertake the work of compilation, which has been done and is now practically complete. The magnitude of this task can be somewhat appreciated when it is realized that it comprised something over 3,500,000 words.

The laws have been indexed for each State and cross-indexed by subject for all the States combined. But the work so far done will form merely a basis for the real purpose of the work of your committee, which is to formulate a plan upon which the various States would be able to revise their road laws so that there may be a proper foundation for highway work throughout the country.

It is evident that much work will be necessary before such a program can be definitely offered. A chart should be made of the present road laws, by which it would be possible to visualize present conditions. With such a chart at hand, there would then be prepared an outline of the fundamental principles that the road legislation in every State should include.

When such a program has been formulated, it is suggested that the State Legislatures be advised of the committee's work, and that provision should be made whereby it would be possible for the committee to come in direct contact with the legislatures of those States that might request such assistance. Inasmuch as your present committee was appointed by the Third American Road Congress, and as the work is so far from complete, it is suggested that there should be constituted in the place of the present committee, a committee of the American Highway Association to carry on the work as here outlined; and it is further suggested that the American Highway Association provide financial aid that would be necessary for the work. Your committee therefore offers the following resolutions:

WHEREAS: On account of the continuous character of the work necessary to be done in connection with the compilation and revision of road laws, and

WHEREAS: The American Road Congress is not a continuing body: Therefore **BE IT RESOLVED:**

First: That the report of the committee on legislation be adopted and the committee discharged;

Second: That the American Highway Association be requested to appoint a standing committee on legislation to continue the work of this committee;

Third: That the American Road Congress expresses its appreciation of the splendid cooperation and value of the assistance rendered by the U. S. Office of Public Roads which has made the work of your committee possible.

Respectfully submitted,

A. N. JOHNSON,
Acting Chairman.

On motion the report of the Committee was adopted, and its recommendations concurred in.

MR. JOHNSON: The committee would further suggest that the chair call upon various members here present to present such views as they have in mind as to what should be embodied in fundamental road legislation.

THE CHAIRMAN: I will first call upon Mr. Henry G. Shirley, of Maryland.

MR. SHIRLEY: This subject is one of the most important before the Congress, in my judgment, and one that should be given close consideration. Your committee has gotten together extracts from all the laws of the different States and if you would put them together, you would have a crazy quilt—they are so different that no one could possibly get up a law that embodies the different phases of all the laws of the different States. I believe it is an impossibility to draw a standard law that will take into consideration all the different conditions that are to be met in each State, but there are cardinal principles in drawing a law which, in my judgment, should be followed in every State in the Union. I think, first, there should be in each State a State Highway Department, a head that can look after the State roads. Then there should be under the same head a State Aid Department; you can govern that as you see fit; then the county laws and the township laws. Now in getting these all compiled, there are certain conditions in each State that will have to be met. Those conditions are restricted to that State, but there are general principles that can be brought out and put into a law that can be applied to every State in the Union, and to every highway department. Mr. Chairman, I think that your committee should be continued and should give every assistance possible to the different legislatures and State highway departments which are trying to improve the many laws they have now. There has been brought before the Congress many instances where the laws of a number of States are absolutely inadequate—they do not cover the conditions at all, and will not meet the requirements on account of not being flexible. In drawing a law, I would like to impress upon the members of the committee, and the different legislatures, that the law be general in its terms. There is always a tendency in legislation to restrict or to practically say how to build a road. "The road shall be built so and so, using sand-clay or macadam." That, in my judgment, is absolutely wrong. The law should be made general and leave it to the highway departments to use their discretion. It has become my duty to have to build a road that had been attempted to be built by the legislature absolutely. They said, "You shall use so many oyster shells and put on so much gravel and put it on so thick," and when I got through I did not have a road at all—there was

nothing there. The law that should be drawn up, in my judgment, should be made broad, giving to the State or county commissioner or highway commissioner broad power. Without proper power you cannot do good work; with proper power you can. If it is badly handled, it is not the fault of the law but of the man who carries out the law, and I think it is very necessary that in drawing a law this very important phase of all the highway legislation should be closely studied so as to draw a law that is flexible and broad and gives each department the proper authority.

THE CHAIRMAN: I will next call upon Mr. S. E. Bradt, Secretary of the Illinois State Highway Department.

MR. BRADT: This is rather a short notice to cover a subject of this kind. I concur in what the gentleman who has just spoken has said as to the organization of highway departments in the several States.

The first thing for a State to determine is whether the commission shall consist of one member or more. The advantage of having the authority centered in one man will very often expedite the work. But in States where a large amount of work is being done and in consequence a large amount of money is being expended, a commission consisting of three members will often get better results and give better satisfaction to the public. Also, with a commission of three members there is the opportunity of making their term of office expire in different years so as to avoid the entire change of officials with a change in administration.

Probably the most important factor in connection with a State highway department is the chief State engineer. Practically every decision which he is called upon to make affects in some degree the efficiency in durability of the work. He should be chosen by the commission and should be selected as much upon his record for accomplishment as upon his technical knowledge. His term of office should be during good behavior.

The further organization of the department will naturally depend upon the scope of the law under which the department is working. In a State doing a large amount of work there should be a bureau of roads in charge of a road engineer, a bureau of bridges in charge of a bridge engineer, a laboratory bureau, an accounting bureau and a bureau of statistics. If the work is of sufficient magnitude, the State should be divided into a number of districts with an engineer in charge of each.

The authority given to the State highway department should at least cover all expenditures, both for construction and maintenance, upon the main roads. And if the State should see fit to give to this department the control of all road and bridge moneys expended in the State, it will add greatly to the efficiency and economy of the entire road work of the State. The law under which the department is working should provide the necessary funds with which

to carry on the work either through State or county appropriations, or both.

It will be greatly to the advantage of the State also if the different counties or parishes shall be authorized to issue bonds upon a vote of the people; thus permitting any particular county or parish where the sentiment is favorable to proceed with the construction of roads and bridges as rapidly as the people of the locality shall demand. I consider there is no danger in going too rapidly provided the people are required to vote upon the proposition, and provided further that the bonds for the road improvement shall be issued so as to mature serially and all within the life of the improvement.

THE CHAIRMAN: I will next call on Mr. Charles J. Bennett, of Connecticut.

MR. BENNETT: This is a surprise. In connection with uniform legislation for highway departments, I think there are certain broad, general principles, that can be laid down. I agree with the previous gentleman that these principles are few and are of great importance. The establishment of a highway department, the establishment of town aid and of aid on all roads in the State, is a very good idea. The establishment of a financial principle which will indicate to the people of the State how much is expected from year to year for highway purposes—all these things can be put in a law, but beyond that one cannot go. In almost every case the administration of the highway department is a purely local problem, one that can be solved only by the locality to which it must be applied, so that the law to be formed by a committee on standard legislation must of necessity contain only these cardinal principles and beyond that each State should draw its own conclusions. The main fault that I have to find with all highway laws is this, that they are altogether too long, they contain altogether too much that is not pertinent to the question at hand, and my plea for a uniform State highway law or for any highway law is to give us one that is brief and clear and in simple English without a great many "Whereas's" and "Aforesaid's" and a whole lot of legal verbiage. If the laws of the States are drawn so that the ordinary man can read and understand them and they mean what they say, we will have taken a great step forward. Most of the States have laws which no one can understand. I know that is true in our particular case and it is true in almost every law with which I have had any connection or of which I have made any study, so whoever draws the standard law, for goodness sake make it clear so that we can understand it.

THE CHAIRMAN: Is there anybody else present who would like to be heard on this subject? If not, I will yield the chair at this point to Mr. J. P. Wilson, member of the State highway commission

of Illinois, who will take charge of the meeting during the remainder of the session. Mr. Wilson.

Mr. Wilson takes the chair.

THE CHAIRMAN: *Ladies and Gentlemen:* Mr. W. G. Edens, who is President of the Highway Improvement Association of Illinois, had been selected to preside at this meeting. In the absence of Mr. Edens they have forced me into harness with the distinct understanding that I would not make a speech. It appears that Mr. Buck and Mr. Stevens are not present, but their papers will be read and the discussion of Colonel Stevens' paper opened by Mr. J. S. Gillespie, Road Commissioner of Allegheny County, Pa.

EFFICIENCY OF HIGHWAY ORGANIZATION

BY COL. E. A. STEVENS

State Highway Commissioner of New Jersey

The very size and the commercial importance of the highway problem in these United States make efficiency necessary to a fully successful solution. Today we can state the problem in general terms only. Even the total mileage of roads and what portion of them have already been improved are only approximately known facts. There has been but little done in the way of scientific planning of State road work, or of any nation-wide system. Yet, even thus, we can easily foresee an expenditure for roads, that, in its totals, is staggering. There is today no need of arguing the necessity of good roads. The questions to be answered are: Where will the roads to be built be located? What will they cost? How are we to insure that, once built, they will give us the service for which they were built, and for which the people are paying? In all of this how are we to insure that the man who pays the bill is not to be taxed more than need be, that he gets value received for every dollar expended?

It would be a foolish man who would undertake to dig the cellar and lay the foundation for his house without first deciding how much room he needed to house his family; how much he could afford to spend therefor; how he is to meet the cost of housekeeping, repairs, insurance, and taxes; and finally how all this is to be done without waste.

In such a case, it is easy to see the need of some forethought. In the much larger problem of providing good roads for this country of ours, the very immensity of the quantities and costs, and the difficulty of gathering the data necessary to state them with approximate accuracy, or the failure to realize the importance of this knowledge, seems to have prevented preliminary study. With our usual national impatience and confidence in ourselves, we have in general tackled the problem with a view limited to a solution over a very

narrow field. Since we took up the subject twenty years or so ago, the problem of administration, design, and construction, have been changed by motor traffic. This traffic has made the road a matter of general and not of local interest; has shown us that hitherto approved methods of construction are no longer generally available, and that systematically organized methods of caring for our roads and of raising our road funds are at least worthy of our most careful thought.

The road conditions of today in New Jersey and Massachusetts may not show the general problem. They are both old, thickly settled States, and they were pioneers in road improvement. But what road improvement has brought about in those States it will in a like way, if not to the same extent, also bring about elsewhere. In both of these States there is a motor registration of about four vehicles per mile of road, exclusive of city streets. In France this figure is about or a little less than four-tenths.

Evidently European experiences are not to be our final and only guide.

Let us therefore look at our problem for a moment without worrying about what others have done. The best way of doing the job is still an unsettled question. On whom shall we place the burden of arriving at the best method? Taking John Fritz's quip that "an engineer is the man who can do with one dollar what any fool can do with two," it is clear that that sort of an engineer is the man we want. Without a force properly drilled in the work, and properly organized to do it, efficiency, the getting for one dollar what with waste will cost us two, is impossible.

With such a force, money and time spent in careful preliminary study, in being sure we are right before we go ahead, will not be wasted. Once when in charge of a machine shop, I hired a new planer hand. Early in the game we had a set of small engine beds to plane. I gave the work, one-half to an old and tried hand, the other to my new man. The special job was new to both of them. The old hand started in to set a bed on his planer without much thought or study, he finished it and set the second in a slightly different way, and had the chips falling from it before my new man did anything but sit still looking at his tool and his castings with his chin in his hands and a look of abstraction on his face. I came near bouncing him then and there, but, on second thought, let him work it out. He had his half done in time to help my old hand out with a few of his castings. That hour or more that looked like a waste of time turned out to be a good investment. We have, and are doing, our work too much in the way of my old and tried man. It is no wonder that roads designed and built without knowledge as to the traffic intensity on them should prove either too weak or more costly than necessary for their purpose. In both cases there is waste.

We need, first, a force that can lay out a well thought out plan with a fair chance to do so without political meddling. The cost

can then be forecast. Changes in traffic may lead to changes in general design and detail as happened at Panama, without making efficiency impossible. The same happens so often with even so simple a task as building a house, that the wise man always allows some margin on the first detailed estimate of cost. With the cost known, plans for raising money can be made for meeting it, and a program of construction arranged with a view of giving the earliest and greatest return for the money spent.

Bond issues and the "pay as you go" plan must be considered. It is evident that over any period for which bonds are issued, the tax levy must include interest and amortization charges on the bonds, as well as the cost of caring for the roads built, and to meet depreciation. If the same amount be raised each year by taxation, and used to meet road building, repair and depreciation charges, it is clear that the amount raised for interest and amortization, and, in the first part of the period, some of the amount raised for repair, etc., can be used for new work. The net result over the whole period is a reduced cost for a given mileage. Against this we have the use of the roads built for a longer average time. This benefit, will, in many cases, be cheap at the increased price, but only on the assumption that bonds are issued on some definite and business-like plan, and the proceeds wisely invested. This has not always been the case.

Any satisfactory road administration must provide for proper design. The data for this is not readily at hand. Traffic figures over an unimproved road bear no relation to the traffic to be expected after improvement. Even were satisfactory traffic data readily available, the economic values of different types of construction are unknown. Motor traffic for not over ten years has been a serious destroyer of road surfaces. It is increasing yearly in intensity. The surfaces specially designed to carry this troublesome and valuable load have not been in use long enough to determine their probable lives and cost of upkeep under the conditions of today. The cost of the road is a yearly one and must include depreciation, if the waste of road material is not made good every year. Therefore, it may well be cheaper to spend money in the repair of a cheap type, such as macadam or gravel, rather than to resurface with an expensive pavement whose life is at the best uncertain.

For example, a macadam road under heavy traffic may be maintained at about the following cost per square yard:

	<i>Cents</i>
Stone, say $\frac{1}{2}$ in. or 42 lbs. @ \$3.00 a ton rolled in place.....	6.3
Bituminous binder, say $\frac{3}{4}$ gal. @ 15 cents, spread and covered.....	5.6
Ditches and drains, say.....	1.0
	<hr/> 12.9

If an improved type of surface is laid on the old macadam at a cost of say \$1.25 a yard, the annual charge to be seen in the tax levy will for some years be merely the cost of ditch and drain work and a small amount to care for imperfections. The community

might, however, have used the \$1.25 for new work, or might have left it with the taxpayer; in either case, it is costing the interest which at 4 per cent is 5 cents. We have then a saving of 6.9 cents, but it seems fair to assume that over a life of from 10 to 20 years we should allow at least 0.9 cent for repairs. Our saving is then 6 cents. We would have to realize this saving for about 21 years to get back our \$1.25 and if the new surface lasts less than that period it may well prove wasteful.

But any such figures are of academic interest only, unless we have the organized repair force needed to keep our roads in repair and a system of accounting that will give accurate data and that is based on an outlook over a period somewhat longer than that covered by next year's tax bill. On the basis of such a system and with such a force are our railroads operated. Their problem is of the same kind as ours—a matter of cheap and efficient transportation. It is perhaps curious that while the tendency of the day is to regulate these and other public service corporations as to the safety and adequacy of their service, and as to their methods of financing, the people of this country have in no case insisted on such safeguards as to the work of those entrusted with their roads.

The engineering problems of railroading have been solved in their broad lines. We will probably be able, as in the past, to keep on increasing axle loads and reducing ton mile costs, but along lines indicated by carefully collected and thoroughly digested data of many years' work. This, as in the past, will be done by thoroughly trained and competent men knowing their business and eagerly looking for ways and means of getting better results.

With our highways problem we are now searching for the best solution. We have, generally speaking, inadequate and untrained or only partially trained forces. We have no accepted traffic unit and no generally recognized system of accounting. These must be supplied if we are to solve our problem as it should be solved.

MR. GILLESPIE: I heartily agree with Colonel Stevens. He has brought out many good points which we must all admit we have been prone to consider too lightly. It is only by careful and thorough consideration that matters of a constructive nature can be materialized. To get efficiency in road construction it is necessary that definite data be secured along the lines of location, type of travel and type of surface. The engineer should not base his figures upon the travel on the old road, but upon the increased travel that will be diverted to the new road. As he states, sufficient attention was not given to these important features when our first roads were constructed or we would not be worrying about the type of surface for the present day travel.

The travel of today was not anticipated 15 or 20 years ago. The heavy trucks have displaced the ordinary horse drawn vehicles, and truck manufacturers seem to be inspired with the idea of "How

big a load can we possibly haul and still maintain touring car speed." This, then brings out the question, are the roads we are now constructing ample for future wear and tear.

The question of efficiency is right. It must be solved and every corporation in existence is endeavoring to reach the highest possible point. To get engineers of ability to place in charge of road construction, is one of the important features. The question of salary, oftentimes, is a drawback. When you get a good man on road work, pay him as much salary as any corporation would be willing to give him.

The road building proposition is an enormous one. People from our boroughs and cities are moving out to the suburbs, purchasing small farms, and travelling back and forth to their places of employment. The steam and electric roads, we admit, will care for a good part of this continual increasing travel, but there are those who have automobiles and must have some type of an improved road which will permit of travel the whole twelve months of the year. The establishment of well considered routes, along the lines of serving the majority of the people, and constructed to stand the wear and tear of a constantly changing mode of travel, is what is required.

The question of financing road improvements, is one that must be considered by the community in which the improvement takes place. The bond issue and the tax levy plan both have their advocates. I, personally, favor the bond issue, for what is considered the most durable or permanent type of surface. Posterity, in my opinion, will not be saddled with an unjust debt. Safe and sane construction and systematic maintenance will insure posterity of a road commensurate with its value.

The question of purchases is one that must be along systematic lines. Carefully prepared specifications, competitive bidding and rigid inspection should be the motto. Once a road is constructed, much can be wasted in the maintenance thereof by inconsistent or lax methods in the purchasing end.

The unit cost system is being advocated more and more. It is therefore necessary that the purchasing of supplies be systematic, properly maintained records, so as to furnish accurate data for the unit cost scheme.

In whole, the road construction game is a serious proposition, and needs to be based along the most simple and best business principles, and, to accomplish this, it will require well considered plans as to location, carefully prepared specifications and rigid inspection, and above all, personal supervision at all times.

SIMPLIFIED SYSTEM OF TOWN HIGHWAY ACCOUNTS

BY FRED BUCK

Assistant Deputy Commissioner, New York State Highway Department

In conducting the work of any town highway system which is organized as a distinct branch of a state system the fact must be constantly borne in mind that, in order to secure the best results possible, simplicity must be the watchword. The comparatively great volume of mileage, the extremely small average amounts available per mile and the agencies through which these amounts must be expended all demand a close adherence to plain and simple methods in all stages of the work, and fully as much in the accounting as in any other branch.

By adopting a system of town highway accounts which can be easily followed by the local officials in charge of the work, two important results are accomplished: First, a complete and accurate accounting of funds expended is secured, and, second, the lessons of order and system learned in this are carried, perhaps in the majority of instances unconsciously, to other parts of the work and a more orderly and systematic management of the whole is secured thereby. Careful and systematic methods in one part of any enterprise will induce the same effort in other portions just as surely as lax and inefficient methods, if allowed to obtain a foothold, will spread from one section to another and gradually seriously impair or destroy the efficiency of the whole.

The system of town highway accounts which went into effect January 1, 1909, as a part of the present highway law of New York State has proven very satisfactory, and excellent results have been obtained under it. In order to clearly understand the workings of this system it must be remembered that the funds for town highway work in New York State are derived from two sources: First, a tax levied by local officials upon the several towns, this tax being supplemented by moneys paid by the State to the towns for the same purpose, which moneys are known as "State aid," the amount payable to each town being dependent upon the assessed valuation per mile of highways of the town and the amount raised by the town as the highway tax in each year. These moneys combined form what is known as the highway fund.

In the prosecution of the work the town superintendent of highways is the man in charge. He hires the men and teams, purchases materials, directs the work and acts as paymaster; the paying, however, being done by means of vouchers issued by himself as town superintendent, the vouchers being redeemed in cash by the supervisor (who is the chief fiscal officer of the town) and retained by him as a receipt for money paid until the close of the fiscal year, when, upon rendition of his annual report and its acceptance by the town board, these vouchers are filed with the town clerk and become a part of the

permanent records of the town. These vouchers, which are furnished to all towns by the State Highway Department, consist of a printed form with the necessary blank space for the insertion of the date, the name of the payee, the dates on which service was rendered, the number of hours of service or quantity of material, as the case may be, and the road for which it was furnished. Each voucher is attached to a stub upon which are blank spaces similar to that of the voucher.

The supervisor is provided with a supervisor's account book, printed and ruled to receive an entry of each voucher paid, spaces being provided for data relative to the voucher corresponding to that in the body of the voucher itself. Pages are provided at regular intervals for a recapitulated statement of vouchers paid, the data upon these recapitulated pages being finally carried forward to a single page thereon condensed into a form of statement, which is the annual report of receipts and disbursements required of each town supervisor under the highway law. Blank forms are provided for such additional copies of this report as are required to be furnished to the county superintendent of highways, the State highway commission and the State comptroller.

No other books nor accounts are necessary for the town superintendent of highways or the supervisor in properly receiving, disbursing and accounting for the highway moneys of any town those which have just been described. With practically no exceptions the town officials are pleased with the form of accounting, and errors and mistakes have been reduced to a minimum so small as to be almost a negligible quantity. Partial audits of the highway accounts of any town are made by a representative of the State highway department at any time during the year when for any reason it shall be deemed that the same is necessary or expedient. By doing this many errors are prevented which might otherwise occur and unwise or extravagant expenditures are prevented, or checked if begun.

Each year a complete audit of the highway accounts of each town in the State is also made, and it is found that the form of voucher and manner of accounting for the same provided for the supervisor greatly simplify and facilitate the work of the auditor.

It is pleasing to be able to state that, while the audits of the first year in which this system was put in operation showed a large amount of errors and discrepancies (due, mainly, to unfamiliarity with the system or to carelessness in making entries) the audits of the years since the first show a constantly decreasing number of inaccuracies. It is also pleasing to be able to state that extremely few instances of actual dishonesty have ever been uncovered and that in very nearly all cases in which reimbursement has been required the occasion for the same was due to ignorance or carelessness and not to actual dishonesty on the part of any town official.

Those who have been most closely associated with the work are also firm in the belief that the quality of the town highway work of the State as a whole and the very excellent results secured have

been contributed to in no small degree by the simplified system of town highway accounting which has been used in connection with the work.

THE CHAIRMAN: We will now pass to the subject of road economics by Mr. J. E. Pennybacker, Chief of Road Economics, U. S. Office of Public Roads.

MR. PENNYBACKER: *Mr. Chairman, Ladies and Gentlemen:* They say that when a man begins to read a paper, he can feel the psychic effect of the audience pulling away from him, and if he looks up from his paper sufficiently he will see them staring at the flags and corners of the room and gradually slipping out. Unfortunately the subject of road economics is one so vaguely understood and so capable of misinterpretation that it is very difficult to give it in a general address with anything like the exactness which the subject deserves. With your kind indulgence therefore I will read the paper—as it is very short—in which I have endeavored to lay down those basic principles of economics which I believe should be the foundation of any scheme for road improvement, whether it be on the part of the State, on the part of the county, or on the part of the municipality. It is undoubtedly true the conditions vary so much in different parts of the country that specific measures to meet conditions must be framed, but running through it all there are these certain fundamental considerations which no county or State can go amiss by observing. I will therefore start out by telling you what I understand road economics to be and then I will lay down the propositions which I consider basic.

ROAD ECONOMICS

BY J. E. PENNYBACKER

Chief of Road Economics, U. S. Office of Public Roads

Road economics may be defined as that branch of economic science which treats of the cost and use of a road as a public utility. Cost and public utility, in a comprehensive interpretation, are the determining factors with reference to the amount of money to be expended, the method of its procurement, the liquidation of any indebtedness incurred in connection therewith, the location of the improvement, the character of the work, economy in the management of the project, and the utilization of the completed road for the economic benefit of the public.

The subject is logically comprised in two divisions, the first of which deals with those larger questions of legislation, finance, organization, road classification or selection, the utilization of collateral agencies, and the management of the road as a completed project.

The second division of the subject although more limited in scope than the first division is important from the standpoint of economy and efficiency, as it relates to the various activities in connection with the actual work of construction. Examples under this division would be the lowering of cost by the intelligent use of labor-saving machinery; the keeping of adequate and efficient cost records so as to detect extravagance, incompetence or dishonesty; the systematic purchase of materials, and the use of such other measures as would serve to produce a satisfactory road at the lowest practicable outlay.

Legislation, to be effective, must be economically sound, and it is necessary to the intelligent framing of road laws that the economic considerations applicable to the subject should be known and accepted by the legislators. A system of financing road improvement is largely the outcome of legislation, but is often modified by the exercise of administrative discretion. Organization, like finance, is to a great extent prescribed by statute, but here again the personal equation enters largely in the determination of efficiency or inefficiency. The utilization of collateral facilities of the State, such as convict labor and the aid of State institutions for investigative and educational work is largely determined by law but here again administrative discretion and the personal equation play an important part. The classification and selection of roads for improvement, although resting upon legislative enactment, are much more largely an administrative question than those to which I have already referred, and the same holds true with reference to the use of the road after completion so as to best serve its purpose as a public utility.

It is thus evident that these basic factors should be correlated and that the undertaking as a whole should conform to those economic considerations which may be regarded as fundamentally sound. I have, therefore, formulated ten fundamental propositions which I hold to be incontrovertible and so self-evident as to be axiomatic. I shall, therefore, first submit these ten axiomatic propositions, and then endeavor to explain to you their practical application.

1. That all who share in the benefits of road improvement should share proportionately in the burdens.

2. That the degree of improvement should be proportionate to the traffic importance of the road improved.

3. That the rate of payment or the rate of accumulation of the sinking fund on any public debt contracted for road improvement should approximately equal the deterioration of the improvement.

4. That road building and maintenance comprise work requiring special qualifications on the part of those who direct it.

5. That responsibilities should be definite as to persons.

6. That continuous employment is more conducive to efficient service than intermittent and temporary employment.

7. That the specialists who direct road work should be appointed

instead of elected; and that they should hold office during efficiency instead of for a fixed term.

8. That no road is wholly permanent and that it requires continuous upkeep, for which financial and supervisory provisions must be made.

9. That cash is a much more satisfactory form of tax than is labor.

10. That all agencies at the disposal of the State, capable of use in works of public improvement, should be so used, rather than in such commercial production as would conflict with private enterprises.

The practical application of these ten axiomatic propositions does not involve intricate or impracticable procedure. Under the first proposition, that burdens and benefits should be shared proportionately, I would call attention to the fact that the country road is no longer a mere local utility. The product of the farm is absolutely essential to the existence of the city population, while, conversely, the product of the city factories finds its way to the most remote country districts. There is an inter-dependence which should carry with it a coöperative sharing of the burdens incident to improving the facilities of transportation between country and city. Legislation should, therefore, be framed so as to provide for city taxation in aid of country road improvement. Automobile owners should individually pay a material portion of the cost of our public roads, and they are already cheerfully doing so in many of the States. Last year the state revenues derived from automobiles amounted to about eight million dollars applicable to roads, out of a total from all sources, State and local, of about two hundred and five million dollars. The exact method of apportioning the road taxes is a detail which can readily be worked out by each individual State.

The second proposition, which calls for the improvement of roads in proportion to their traffic importance, strikes at the very root of our present method of apportioning road improvement. Too often have we seen examples of costly improvements distributed according to the dictates of a few influential citizens or according to some arbitrary arrangement of political units or for sentimental reasons, or through a cheerful, haphazard indifference. It is now generally believed that four-fifths of the traffic of this country is carried on one-fifth of the road mileage. It should be manifest that the most heavily traveled roads should first receive attention and should be improved in the most substantial manner. It is entirely feasible to make an expert study of a county road system and indicate graphically the traffic areas for each important road, much as you would show drainage areas for waterways. The yield and the probable traffic in ton miles for these traffic areas can be readily determined so as to establish with reasonable exactness the amount of outlay which the traffic would justify. The relative cost of such a determination would be almost negligible if incurred as a preliminary to a large outlay for actual construction.

The third proposition, that debts should be liquidated in proportion to the deterioration of the road, is intended to prevent the incurring of a debt which will outlive the utility which it was designed to create. There are two extremes in the controversy which rages over this question of public debt. There is the one faction which either opposes debt in any degree, or contends for an indebtedness of such short term as to make it almost a cash transaction, and asserts that the road is entirely destroyed long before the debt becomes due. The other extreme faction contends for long-term indebtedness, on the theory that as posterity will reap the benefits it should bear the burdens, and that a road well maintained never wears out. As a matter of fact, location, if intelligently made, should be permanent; likewise all reduction of grades. The drainage features, if honestly and efficiently constructed, should be reasonably permanent. The road, except under extraordinary conditions, should, therefore, be considered reasonably permanent as to these features. As a general rule, the foundation of a road should not require renewal if the road is subjected to adequate and continuous maintenance. Avoiding any detailed consideration of the exact proportion of the total cost of a road represented by these features, I should say that in general the permanent features would average at least 50 per cent of the total cost. So that, if the other 50 per cent must be figured as perishable and subject to renewal, the debt should not cover a period longer than twice the length of this perishable portion. For example, if a macadam road is constructed at a cost of \$6,000 per mile and has an estimated life of ten years, the bonds could run twenty years, because, at the end of ten years the depreciation is \$3,000 and the actual value is \$3000. Another expenditure of \$3000 is made and at the end of the twenty years when the bonds become due, there has been a total outlay of \$9000, against which should be credited the permanent value of the road at \$3000, making the net outlay \$6000, or the face amount of the bonds. This is merely an example and a generalization. It would be desirable to ascertain the permanent and perishable portions in each undertaking.

The fourth proposition, which calls for the employment of specialists in road work, is so nearly self-evident in its application as to require very little explanation. I should say, however, that if the laws of the State would require that all persons selected to have immediate direction of road or bridge construction and maintenance must possess practical knowledge and experience, and if this fitness should be tested by some sort of competitive examination to be prescribed by a State highway department, acting either directly or through a civil service commission, the net result would undoubtedly be the saving of many millions of dollars of road revenue and a wonderfully increased efficiency in our road system.

The fifth proposition, that responsibilities should be definite as to persons, is aimed at the elimination of our present complex and

cumbersome system of road management. If all of this antiquated organization could be swept aside and in its stead one or a few officials endowed with authority and charged with responsibility in each county, the beneficial effects could not fail to be most marked. If the people, individually or in a representative capacity, could immediately place their finger, so to speak, upon the man responsible for the discharge of public duties we should have no more political juggling and the passing of responsibilities and duties onward in an endless chain.

The sixth proposition, that continuous employment is more conducive to efficiency than temporary employment, finds its antithesis in our present annual or semi-annual junket which we call "working the roads." It is so self-evident that a minor defect in a road can be repaired at its inception with little effort, and that if allowed to go on it may require the entire reconstruction of the road surface, that it seems scarcely necessary to urge the soundness of this proposition. If a small force of laborers with necessary tools and teams were employed throughout the year on the roads it would not cost any more money than to call out a small-sized army of road hands twice a year, and would not only result in quick repairs where needed but would also insure that the most work would be done at the places where it was most needed. The force would be small, mobile, trained, interested, subject to effective discipline and altogether infinitely more efficient than the unwieldy forces now employed.

The seventh proposition, which calls for appointment rather than election and for the holding of office during efficiency instead of for fixed terms, is designed to attract to the work men who look upon road-building as a life profession or occupation. A good engineer may be a very poor politician and a good politician may be a very poor engineer, but in a contest in which votes are essential the good politician will usually defeat the good engineer, although the position requires engineering ability rather than political ability. Do not spoil a good highway engineer or superintendent by making him cater to the popular fancy. If he is the right man in the right place, it is absurd to limit him to a fixed term, for his position is not a reward. The county is purchasing his services and is supposed to get value received, and it should continue to purchase so long as he delivers the goods.

The eighth proposition, that no road is wholly permanent and that it requires continuous upkeep, is intended to impress upon legislators and administrative officials the necessity for making adequate financial provision to care for roads, no matter how costly or efficient their construction. A house is not permanent without repair, a railroad track is not permanent without repair, then why should public funds in a large amount be expended in road construction which, without adequate maintenance, may deteriorate to the extent of 50 per cent in a few years. It would seem almost a reflection upon your intelligence that I should urge upon you these conclusions which

are so generally understood and accepted, were it not for the fact that their acceptance is very largely in theory and not in actual practice.

The ninth proposition, that cash is a much more satisfactory form of tax than labor, is put forward as a protest against the continued cherishing that old heirloom known as "statute labor." If A owes B \$10 and B has the option of collecting that \$10 in cash or taking the amount out in labor which A shall select and which is totally unfamiliar with the character of work which B requires and which would be semi-independent of any control by B, we should consider it very unsound business judgment if B were to accept the payment in labor instead of cash. If you provide an efficient highway engineer or county superintendent with a modest amount of cash and let him select competent, efficient laborers, he can quadruple the effective results obtained by the same number of laborers under the old statute system. I know that there are sections of country where it is almost impossible to collect a cash tax. A certain amount of discretion might in such cases be entrusted to the county authorities to accept payment in labor.

The tenth proposition, that state agencies which may be used in works of public improvement should be so used instead of in commercial undertakings, is directed partially toward the convict labor question, and is based upon the assumption that offenders against society owe a debt to society which should be paid in such form as will most benefit society, and the further assumption that honest labor should not be discriminated against through the sale or disposal of products created by criminal labor. The practical application of this proposition would mean the employment of convicts in road-building, the preparation of road materials, or in other works of public improvement so far as practicable. This proposition is intended also to emphasize the necessity for correlation of the States' various agencies in the interest of road improvement. For example, a State geologist should be helpful in the selection and location of road materials, the laboratories of state universities should be useful in the testing of materials, the university staff should be helpful in the giving of theoretical instruction and in many cases in practical extension work, state bureaus of statistics and agriculture should be helpful in accumulating essential data for the road improvement work in the State, and state civil service commissions should be of very great use in the inauguration and conduct of the merit system in the filling of positions requiring technical or practical qualifications and experience.

The subject of road economics is entirely too far reaching to be adequately treated in one paper, and I consider it more advisable to present to you these fundamental considerations than to attempt a hurried and general treatment of the whole subject. You can readily see that under the first division of the subject as I have outlined it, there yet remains a great field for analysis and discussion

in the detailed application of systems of finance and taxation and in the organization and working policies of highway departments for state and local work. These, I trust, may be dealt with in due time by others, although I may say that it is my purpose to pursue the subject further as one of the projects of my division in the United States Office of Public Roads.

The second division of the subject to which I referred briefly in the opening paragraphs of my paper and which relates to the efficient and economical management of the actual work of construction is important enough for a separate paper. I have pointed out a few examples to show you what this division of the subject comprises, but it is manifestly impossible for me, in the space allotted, to take up the second division even in a general way. The time is fast coming, however, when only those contractors and those officials and engineers in charge of force account work who devote attention to the economics of actual construction can obtain material success.

THE CHAIRMAN: There will be a meeting of the Executive Committee of the American Road Congress, at 3 p.m. Wednesday, tomorrow, in room 326 Georgian Terrace Hotel. The purpose of this meeting is to give hearings to delegates from cities desiring next year's Congress, and the committee requests that all those who are interested in this meeting will please be present. Next will be a paper entitled Educational Field for Highway Departments, by Dr. Joseph Hyde Pratt, State Geologist of North Carolina.

EDUCATIONAL FIELD FOR HIGHWAY DEPARTMENT

BY JOSEPH HYDE PRATT

State Geologist and Highway Engineer

There is undoubtedly a wide field of work for all highway departments in an educational line, regardless of the length of time that the highway department may have been in existence or the actual amount of work that it has accomplished. I do not believe that any State highway department has at the present time absolute control of the location, construction and maintenance of all highways within the borders of its State, but, on the contrary, there are, besides the State highways, county and township highways. Over these latter systems, the State highway department would probably have, in most cases, no actual control but would simply act in an advisory capacity. In many States individualism and sectionalism, as opposed to what might be termed a State-wide community spirit, are at the present time a positive detriment to the general advancement of the State. This is particularly true in connection with the public road movement of many of our States. It is exceedingly difficult to get the members of our general assemblies to consider

the road problem as really a State-wide one, and although in many States there have been organized very efficient State highway departments, they have been limited in their power and limited in the roads that they can control.

For these reasons the work of a highway department is sometimes very greatly handicapped, and its efficiency very materially reduced. These conditions can only be remedied by bringing our people into a fuller realization that public road construction is a business proposition and that the best results can only be obtained when their location, construction and maintenance are under the supervision of a competent head. To accomplish this it is necessary that the people be informed of existing conditions, the need for changing these conditions, how it can be accomplished and the benefits that will result to the State.

The educational work that can and should be carried on by highway departments readily divides itself into three groups:

I. Educational work as it relates to the employees of the highway department.

II. As it relates to county and township road officials.

III. As it relates to the people of the State.

I. I believe there is very great need in many highway departments for the engineers connected with them to be in closer touch with each other and the head of the department. It seems to me that at least once a year there should be a general meeting of all the State engineers and superintendents to be held at some suitable and convenient point in the State, where they would have the opportunity of bringing before the meeting problems that have come up in connection with their individual work and upon which they desire information and assistance. General instructions should be given at such meetings by the State highway commissioner or engineer as to the general policy of the department and the character of the work that they wish to accomplish. I believe that by so doing, the efficiency of the work of the department will be increased and the engineers and superintendents themselves will take a more lively and a keener interest in seeing that the work accomplished is of the very highest order and that the part of the organization under their administration is the most efficient.

For such a conference there is no reason why all the engineers connected with the department should not get together, because they can be ordered to attend by the commissioner, and such attendance should be considered as part of their official duties, and all expenses incurred by the engineers should be borne by the highway department. It is not a bad idea to have in attendance at such a conference some engineer of national reputation to address the members.

The State highway department will find that it is necessary to train and educate young men in order to develop a corps of engineers

of sufficient magnitude to carry on the work that is required of the department. A student just out from college, although having received the best training in the highway engineering department, is not a competent highway engineer, but is capable of becoming one. He can work well under more experienced men, but is not in a position to take charge of road work at the beginning of his career, and he cannot develop into a competent highway engineer without working under and coming in contact with more experienced men. The meetings referred to above are of very great importance and benefit to this type of man, and are of very material assistance in training him for the work that will be required of him.

II. The educational field of the highway department, in connection with county and township road officials, will have to be coöperative. As the State highway department has absolute control only over State roads, and as the county and township road commissions have control over the balance of the roads, there is very great need in many instances for a highway department to carry on educational work in the counties and townships.

In the first place, the highway department must be able to show that they have something to give to the county that is better than the county has in connection with its road work. First of all, they must bring the county and road commissioners to a realization that it is just as necessary that they have a competent engineer in charge of their county road work as it is for the State in State work, and if the State roads have been built in a creditable manner, there is not much difficulty in demonstrating this point to the county officials. It is harder, however, to convince the county and township officials that it is necessary to have men trained in road construction to act as superintendents of their roads. It is in the appointment of superintendents and foremen that politics has played too great a part in road work, and to the detriment of the resulting road. These men should be absolutely under the control of the highway engineer, and, as stated above, should be men who are familiar with and trained in road work.

These men need to keep up with the advancements made in road construction and maintenance, and in order to keep them abreast of the times, I believe that road institutes should be held in the counties at certain intervals, at which time various subjects relating to road location, construction and maintenance should be taken up and discussed. The county superintendent of roads or county road engineer, if there should be one, should hold these meetings once a month or once in two months, when he will go over with his foremen and supervisors different phases of the road work and give them an opportunity to bring up any questions or problems that have come up during the previous month in regard to their work. The State highway department should have general supervision of these foremen's institutes.

It will be found that such institutes will react very favorably on the foremen, and will cause them to take a much greater interest in their work and make them realize that they are a part of an organization which is building up their county or district. One particular feature that is constantly needing development, and regarding which supervisors and foremen need constant instruction, is in connection with the maintenance of their roads, and at these institutes instruction and directions can be given as to how to repair temporarily serious breaks on bridges, culverts or the surface of the road, so that the road is made passable until the superintendent can be notified and a force of road men detailed to make the permanent repairs.

Those connected with the construction of public roads are like any other set of men, in that if they can be made to have a personal interest in their work, they accomplish more and with better results. I believe this personal interest of the road men is of as great or greater value in connection with building roads as in any other kind of work, inasmuch as the question of the disposal of dirt and rock in grading is so dependent on the road men themselves that they can very often waste a lot of dirt and also a great deal of time unless someone is standing over them constantly directing each individual man's work.

The highway department should supply books of instruction for the superintendent, foremen and supervisors, and if used in connection with the institutes they will very materially increase the value of the institute and the efficiency of the men. I have found that the information which it is desired to convey to the road engineers, superintendents and foremen is perhaps better supplied by short pamphlets on the different subjects than by trying to bring it all under one book. Thus the highway division of which I am director has published a series of Good Roads Circulars for the use of the engineers, superintendents and foremen of North Carolina on the following subjects:

Dirt Roads and Their Maintenance.

Suggestions to Road Officials Concerning the Construction and Drainage of Public Roads.

Construction of the Sand-Clay Road.

Status and Duties of the Road Engineer.

Economics of Convict Labor in Road Construction.

Organization of Road Forces.

The Use of the Abney Hand Level.

Construction of the Split Log Drag.

Culverts and Small Bridges for County Roads.

At least once a year State highway department should call an open meeting in each county, to be held at the office of the county or road commissioners, for the purpose of affording instruction relative to matters pertaining to road and bridge construction and maintenance, and one of the State highway engineers should be detailed to conduct the meeting. Upon receipt of such notice from the State

highway department, the county commissioners shall call such meeting on the date set by the State highway department and shall be present themselves and notify the county engineer, the road officials of each township and the county road superintendent or district road superintendents to be present at such meetings in person. Each of the road officials thus notified to attend shall be paid the regular per diem allowance and expenses in the usual manner for the actual time in attendance at such meeting. If the above is incorporated as part of the official duties of the State highway department, it becomes obligatory upon them to call these meetings and also makes it obligatory upon the county officials to attend.

Once a year there should be held a good roads institute, either in the office of the State highway department or, preferably, at the State university or other State institution, where a course in highway engineering is given. At such an institute, which should be held for at least a week, all county and township engineers and superintendents should be obliged to attend as part of their official duties. The program for the institute should be worked out by the State highway department in coöperation with the State educational institution, if the institute is held at the latter place. It will be found that as these institutes are carried on from year to year, they soon become clearing houses for all road problems of the State in which they are held.

Road officials should be encouraged to subscribe to one or more road magazines. I believe it will be found very efficacious for the counties to subscribe for these magazines and have them sent to their road officials.

III. In some States the educational work that a highway department can carry on in connection with informing the people of the State as to the road situation, is the most important phase of educational work to be done. As we all know, the status and life of a State highway department are dependent upon the people, and such a department can only live and develop as it is able to show to the people that it is efficient and of economic value to the State.

Where we have the three sets of road officials—State, county and township—in charge of different portions of a State's system of roads, there is more or less conflict between the county and township officials and the State officials, and this is apt to engender a feeling of antagonism against the State department. This will always be the case until our people, as a whole, realize that the welfare of the State must come before that of the county; the county before that of the township; the township before that of the community, and the community before that of the individual family. At the present time, in many States we are apt to consider things in reverse order to what I have just mentioned. We cannot afford to develop a county at the expense of the State.

I believe that a State highway department should show to the people of a State the work it is doing, what it has accomplished and what it expects to accomplish. This can be done very effectively by illustrated lectures to be given at the county seats, and by the publication of reports, giving a description of the work done during the previous year. These should be illustrated, and in this connection it will be found that coöperative work with counties can be very advantageously carried on by illustrating in the reports the best work that has been done in several of the counties, giving in connection with the illustrations cost of the construction work. It will be an incentive for county officials to try to see that they get the best results at the least cost.

In many States, counties and townships have been authorized by the legislature to issue bonds for road construction. In some States the State highway department has the supervision of the location of the roads which shall be built after the bond issue. In other States the whole control of the expenditure of the bond issues is left to the local authorities. In this case the State highway department could only act in an advisory capacity. They should, however, try in every way to give assistance to the local road officials, not only in the location of the road, but in its method of construction. This will be accomplished largely by educational methods. This can be brought about by consultation of engineers of the State highway department with the local road officials. In giving advice regarding the location, they should explain in detail their reasons for the location made, and show how, in the end, it makes a cheaper and better road. They should assist in the determination of suitable surfacing material and advise the local officials as to the most suitable and economical material available for their use.

Instruction by means of publications and conferences should be given local road officials in regard to bridge and culvert work. Specification blanks can be prepared for distribution amongst the counties on request.

In constructing a system of improved roads in any State, there will probably not be over 50 to 75 per cent of the roads that will have hard surfaces, and the balance will come under the head of dirt roads. In some States 60 per cent of the roads will be dirt roads. For this reason it is a good policy for a State highway department to give serious consideration to the care and upkeep of the dirt road, and they should call the attention of local road officials to this and give them instruction as to the maintenance of such roads. Circulars can be prepared and distributed to advantage amongst the people of a State, describing the system of improved roads and calling attention to the dirt roads leading to them, and how, by a little thought and care, these dirt roads may be kept in hard, good condition the greater portion of the year. I do not believe any of our State highway departments are giving sufficient thought and

consideration to the dirt road, and I am confident that a great deal of good can be accomplished by these departments giving more heed to this kind of road and instructing road officials as to their construction and maintenance.

It is just as necessary that men skilled in road work have supervision of the construction and maintenance of the dirt road as the dirt road. I do not believe it is putting it too strongly to say that one-tenth to one-fifth of the time and labor expended in all our States in public road work is absolutely wasted, and this is practically true of the amount expended in connection with the dirt road. The State highway department should consider it one of their duties to give such instruction as may be necessary to enable the people to save this enormous amount of money that is now being wasted each year.

With the advent of the automobile traffic conditions on the public roads have been very materially changed, and not only is it necessary for the State highway department to make a thorough study of these new traffic conditions and the effect of these new vehicles on the public road, but it is also necessary for the department to give instruction and advice to the users of these vehicles, as to the effect of such traffic on the roads and why it is necessary to legislate in regard to their use. The passage of laws regulating traffic will not be sufficient to control it for a great many years unless the users of the road are educated as to the need of such traffic regulations. Therefore circulars should be prepared and distributed, discussing the speed laws, method of passing vehicles, the rights that the users of vehicles have on the public roads, and the license fees or tax required of all users of the roads. I believe that as we are able to inform our people in regard to the public road, that it belongs to all the people and not to any one class of users, and that the laws and regulations regarding the use of the public roads are passed in order to make the road of greatest service to the greatest number of people, that such regulations can soon be enforced with but little difficulty.

The new traffic conditions have increased the dangers of a traveler on the public road, and I think the highway departments should begin to take up a plan of educational work that has been inaugurated, by the railroads, that is, "Safety first." Pamphlets should be supplied to users of the road, cautioning them in using the road to give first consideration to the safety of other users of the road, and therefore be careful in passing other vehicles and in rounding sharp turns. If all would cooperate and have the public's interest at heart, the accidents that occur on our public roads could be reduced to a minimum. Each year there are an enormous number of accidents at railroad crossings, some of which are due to carelessness of the driver, others to the bad condition of the crossing, and some due to negligence of the railroad. Here again is an opportunity for the State highway departments to do very efficient educational work.

Have warning notices posted at railroad crossings. Have cards for distribution, cautioning all users of the road to take extra precautions in crossing railroad tracks. The greatest good, however, can be accomplished by working out a standard plan of crossing for a railroad, when an overhead or underground crossing is not possible. Do not approach a railroad crossing on a grade of over $4\frac{1}{2}$ per cent, and if possible, for 15 feet each side of the rails themselves have the road level. Then keep the road-bed smooth and hard and the space between the tracks flush with the rail.

In order to carry out this, it will be necessary to obtain the co-operation of the local road officials and the railroads. But as it is right in line with the "safety first" movement of the railroad, little difficulty should be encountered in obtaining their coöperation.

In many States the governors are issuing proclamations for civic days, and usually one of these days is known as Good Roads Day. Here the State highway departments have a splendid opportunity of getting in direct contact with those people that have the welfare of the state at heart. The departments can assist the communities in arranging programs for good roads days and furnishing lectures as far as possible.

One other phase of educational work that is, perhaps, as important as any thus far discussed, is that of constructing a sample of model road in those sections of the State where there are no good roads and the people are not aroused to their need of them and the beneficial results that can be derived from them. The construction of a quarter to a half a mile, or even one or two hundred yards of good road in such a community will often be the means of arousing the community to a realization of what they need, with the result that they soon work out a plan by which they can obtain a system of good roads.

THE CHAIRMAN: The discussion of Dr. Pratt's paper will be opened by our friend from Oklahoma, Col. Sidney Suggs, State Highway Commissioner.

MR. SUGGS: *Mr. President and Delegates:* In opening this discussion, I fully realize its great importance and far reaching effect. It is not my desire to indulge in theories, but will, as briefly as possible, draw a practical application of the subject to the conditions which have had to be met in my State where I am best acquainted with conditions. This subject peculiarly applies to Oklahoma for the reason that my department has been made almost exclusively an educational department. There has never been as much as one dollar appropriated for the use of the department notwithstanding the creation of the department was provided for in the constitution in a clause which reads, "The legislature is hereby directed to create a department of highways."

I was president of the Indian Territory Good Roads Association

while W. R. Goit was president of the Oklahoma Good Roads Association. After Statehood, the two associations were consolidated, we began activities with the formation of the new State, a legislative committee was appointed to meet with the constitutional committee on highways. The constitutional provision requiring the creation of a department of highways was the result of the work done by the legislative committee. The first and second legislatures gave little or no heed to this constitutional provision, the committee, however, was persistent, and by determined and intelligent effort succeeded in getting the third legislature to vitalize this provision of the constitution.

The vote was close, in fact, State Senator Pat Gouilding who is now serving on the Capitol Building Commission, changed his vote in order to vitalize this provision of the constitution. The State department of highways was created, the bill provided for the appointment of a commissioner of highways by the governor. The law conferred powers upon the department and defined its multiplicity of duties, but it failed to appropriate as much as one dollar for its use. As a means of support a State license fee of \$1 was taxed against every automobile in the State, but there was no penalty attached to failure to pay, and the collection of this tax has been expensive and very humiliating to the department.

Notwithstanding this handicap, the department has gone forward with the duties prescribed by the legislature. It has collected much valuable data and has laid out and made a map of over 2,400 miles of State roads, which have been submitted to the legislature, and which have been approved by the president and secretary of the State Good Roads Association, and have been sent to the joint committee of congress.

The department, by diligent and systematic inquiry learned that 3,300 township trustees were spending from road levies and from bond issues from three and a half to four millions of dollars annually, without the assistance or advice of an engineer. This enormous waste may be illustrated by comparing it with the story of the old lady who carried water from the spring to the chicken lot in a pan full of holes—the water all leaked out before she got to the chicken trough. Large sums of money and much energy have been wasted, and we are still in the mud.

The removal of the 3,300 township trustees proved to be a difficult task, inasmuch as a few of these township trustees were backed by what we term in Oklahoma, the wrinkled tin culvert, tin bridge and toy tool grafters who claimed that the highway department was interfering with home industry. The fight for their elimination has, I am proud to say, been fairly successful. Township officials in most of the townships have retired to private life and the rest of them are making arrangements to retire as soon as the taxpayers of their respective counties take a vote upon their elimi-

nation as the law provides. So much for the early road history of Oklahoma, and this brings us up to the present.

I fully agree with Dr. Pratt when he says there is a wide field of useful work for all highway departments along educational lines. In this connection I am pleased to report that in Oklahoma we have taken this proposition to the rural and high school pupils, both boys and girls, and since the 12th of last month we have carried the message to 3,000 pupils, and have organized *Good Road and Civic Clubs* in four counties. On the 16th and 17th of October the high school pupils of Seminole county built the first mile of educational road in the State. So much interest was manifested by the pupils on this occasion in the construction of the road that a scheduled football game was abandoned in order that they might do the work. The construction work was done by the student body, including the paying of the expenses of the engineer, the driving of the grade stakes, and the carrying of the chain and leveling rod. The width of this road is 20 feet from curb to curb, leaving a parkway on either side. The high school girls who have charge of the civic department of the work, assisted the boys in setting out nut and fruit trees along this educational mile of road. In Stevens county there have already been organized 1,500 pupils and plans have been made to build a mile of educational road in each of the three county commissioners' districts. The county school superintendent, Mr. A. L. Morton is taking a lively interest in this work and declares that the pupils of Stevens county, 8,623 in number, will build one mile of educational road in each of the seventy-five school districts in the county. All work is to be done under the direction of a competent engineer, who holds a commission from the department of highways, and at the expense of the organization. This engineer is instructed to make plans, profiles and specifications, giving first the location, width of road, the drainage, the size and location of culverts and bridges, according to the topography of the abutting lands, the plans state how much clearing is to be done, the number of yards of earth or rock to be moved, together with the estimated cost of each mile; tools and material are to be furnished by the commissioners. When preparations are completed, when the material is on the ground for the culverts and small bridges, the delegates regularly elected, dressed in their working clothes, from each school in the county, will come and do the work themselves under the direction of the engineer commissioned by the State Highway Department. Plans will be made for the constant dragging of the road. At the proper season the girls will finish the work by setting out trees along both sides of the highway. Some of our nurserymen have already agreed to furnish trees free of charge in localities where they cannot be gathered from the forest. Our State superintendent of schools has caught the inspiration and will at once embrace the study of scientific road building in all the schools of the State. In my opinion this is a

most important subject, it is one, my friends, that means more to all the people than any other that is before the public for unbiased, conscientious and sincere discussion, and is well worthy of the consideration of the most progressive and brainiest thinkers of the age.

Mr. President and delegates of this convention. I trust that in your wisdom you will take up the *Unit System of Road Owning, Improving and Maintaining*, having for its slogan *Safety, Economy and Permanence*, and to establish State roads which are to be built and maintained by the State with its own resources. Let those resources come from prison labor, automobile tax, pipe line tax, telephone tax, or from any other source of revenue. The State can then, under the Department of Highways, proceed to lay out State roads along the lines of least resistance, avoid springy places, movable sand beds and impassable grades. These roads will naturally pass through counties, and townships, relieving the tax payers of the counties and townships through which they pass of the burden of building and maintaining these roads forever, from the fact that they at once become the property of the State and are one of its most valuable assets. This system would demand the organization of State road districts numbered in the order of their organization.

The suggestion has been made to do away with 7500 road overseers who under our present condition (not worthy to be called a system) are allowed \$80 per annum each, or \$600,000 each year and to substitute for the present system of warning out all able bodied men and boys to work the road four days in the year or pay \$5 in cash, the plan of collecting from each man who is subject to road duty one-half of this amount, \$2.50 and place these sums in the hands of the county treasurer with other road funds, to be divided among the county and township road commissioners by some fixed rule. A county road commissioner and a county engineer should be appointed by the commissioners on efficiency alone, requiring them to execute a suitable bond for the faithful performance of their duties, and a proper accounting for every dollar spent on the county roads. All county roads should be designated and marked county lateral roads connecting with other counties and built to the State roads. Township lateral roads are to be built, owned and maintained by township to connect with county roads, all State, county and township roads must harmonize. This system, in my opinion, will solve the road problem in each State, and at the same time be a great incentive to the educational construction and maintenance of all the roads within the State.

I suggest that you appoint a committee composed of highway commissioners and engineers to work out a unit plan along the lines above mentioned and to make report to this congress. The result of this committee's work to be submitted to the different State legislatures.

In Oklahoma there are 50,000 miles of dirt roads that will be good 90 per cent of the time if they are properly drained, graded

and crowned, then kept up with light wooden drags. The rural and high school pupils are also taught the art of building sand-clay and clay-sand roads, realizing that a good foundation must be laid for a hard surface or metal road, we are at least laying this foundation. We have already taken up the safety crossing for railroads, the department has made standard plans that have been carefully gone over and endorsed by the corporation commission and accepted by a number of the railways of the State.

In Oklahoma we are discouraging grade or surface crossings, and asking wherever it is possible, overhead or under-crossings be adopted. *Safety First* is the motto. I also agree heartily with Dr. Pratt in his recommendation that all State and county engineers, together with road commissioners should meet at least once a year for the purpose of comparing notes and working out problems that present themselves in connection with their individual work. This organization should, in my opinion, extend to the States so that all road work could be harmonized. Some may disagree with me when I assert that no standard plans can be established for the building or maintaining of earth roads. This, I contend, is absolutely impossible from the fact that we have so many different kinds of soil to contend with through which the roads pass, so we, in Oklahoma, have decided to make the best we can out of what we have, and we believe that a well drained, well graded and properly crowned road, kept up by the frequent use of the wooden drag, is the best road for the hoof or the wheel, at least, it is much better than a poorly built and poorly drained hard surface road, and is much easier and cheaper to maintain.

With your permission I want to go on record as saying that it requires more brains, more efficient engineering and more patience to build a good dirt road than it does to build almost any kind of a hard surface road. I mean the building of a road that will some time in the future be the substantial and everlasting foundation of a hard surface road. I tell my people in every community that I visit, that some day the government will organize and begin the building, owning and maintaining of a system of highways, and we must be able to turn over to them a good foundation for their road, and urge every community to take great pains with their engineering and construction of every mile they build, no matter whether it be a State, county or township road. Then, if it is ever used for a hard surface road, they will be consoled by the fact that they will have at least the best road that can possibly be built out of the material at hand. One can hardly find a road 5 miles in length, without coming across 100 and possibly 200 feet of road that is always good, no matter what the rainfall is or the traffic along this particular road. Why is this? I have often put this question to road overseers and road commissioners, and then had to answer that it was nature-mixed and nature-drained, now let us intelligently try and imitate nature's work.

Now, as to the automobile proposition, I believe that it is the duty of all automobile manufacturers' associations and all automobile owners to take up automobile legislation. They should be interested more than any other class in the building of good roads, especially as to the conservation and preserving of the roads over which they travel and the duties of the drivers as to the passing of other vehicles, turning sharp corners, in fact, everything pertaining to the life of the automobile and its traffic, and those interested in road building would prove to be great allies in assisting in getting such legislation as will be effective. This is a matter which concerns not only the driver of a 60-horse-power car, but down to the poor fellow who is walking with a stick along the public highways and is liable to be run down even by the most careful driver.

THE CHAIRMAN: Next will be a paper entitled "The Extent to Which Engineering Schools Should Devote Attention to Highway Engineering Instruction," by Prof. E. J. McCaustland, Dean of the School of Engineering, University of Missouri, Columbia, Mo.

THE EXTENT TO WHICH ENGINEERING SCHOOLS SHOULD DEVOTE ATTENTION TO HIGHWAY ENGINEERING INSTRUCTION

BY E. J. McCAUSTLAND

Dean, School of Engineering, University of Missouri, Columbia, Mo.

The extent to which engineering schools should devote attention to any particular phase of instruction should depend in a great measure upon the recognized importance of that phase of engineering when considered in connection with the economic and social life of the people of the State and nation.

This does not mean an importance measured solely by the amount of public interest at any particular time, for such interest is often aroused in connection with matters which are of only minor importance. It does not mean an importance measured by the opportunities for men to secure remunerative employment, although such reason should not be wholly ignored. Nor does it mean an importance measured by the amount of public moneys expended, for it is a matter of common knowledge that money is at times lavishly poured out for very inconsequential, trivial or temporary purposes. What it does mean, however, is an importance having its roots in those essential matters which function so largely in extending and enlarging the field of human progress, development and ultimate happiness. Such matters are, the extension of education; nurture and development of religious and social life, the promotion of ease and comfort of living, and in a word, everything which helps to advance civilization.

Much has been written and spoken on the relation of good and bad roads to illiteracy and on the restrictions in the way of religious

growth and social development in communities brought about by impassable country roads. These relations and restrictions are so clearly and so generally understood that it is only necessary to mention them in this connection. No one will deny their truth and their overshadowing importance.

Gaged then by this final standard, highway engineering should have recognition in any scheme devoted to the training of civil engineers.

The question of the amount and character of such special recognition depends, of course, upon the fundamental plan of organization of the civil engineering curriculum under consideration.

The foundation work in the mathematical and physical sciences as commonly included in civil engineering courses is admirably adapted to furnish the necessary and sufficient basis for an excellent training in highway engineering. This fundamental science training involves, among other things, specific preparation in the fields of surveying, chemistry, geology, and economics. For the highway engineer there is need of special concentration on all of these subjects in order to enable him to make the application of their underlying principles to the practical problems he will meet in his professional experience. This "special concentration" may be embodied within the limits of a very few credit hours, and every course in civil engineering should make provision for it.

In courses of elementary surveying and in railroad curves, land surveying and railroad location afford the practical problems and furnish the ultimate purpose for the course, so far as such purpose is purely practical. But railway location is highly specialized, and the attention of the student during his study should be called by way of contrast to problems of highway location. Similarity in the problem should be made clear, and contrasts emphasized for further study. Train resistance, compensation of curves, and cross-sections of roadbed for railroads are very different problems from kinds of traffic, ruling grades, sight distances and maximum curvature on highways. Many highway locations have been spoiled by railroad engineers who could not adapt their knowledge to the demands of their problem. It is for the schools to train their men to "sense" their problems before they attempt a solution. This can be done only by "special concentration" as noted above.

In chemistry, the under graduate student in highway engineering should have a very specialized course in organic chemistry, elementary in its nature, but concise in its application with reference to the principal series of hydrocarbons. He should know how to interpret properly, if not himself perform, all the standard tests on bituminous materials and he should be able to judge fairly of the proper field for the use of road oils both for binding material and as dust palliatives.

Bituminous materials are growing in favor and in extent of use every year for roads and pavements and scores of practicing high-

way engineers are entirely ignorant of the characteristics of such materials. They purchase at random, manipulate by trial, and wonder why their roads fall to pieces.

All men being trained as civil engineers should have a general course in geology and for highway engineers this should be followed by a special course dealing with the origin, nature and physical characteristics of soils. Since by far the greater proportion of the roads of the country are now, and for a long period to come will be constructed of earth it is clear that the study of soils must be of prime importance. In most road building the soil is to be compacted to furnish a foundation, and in all road foundations drainage must be accomplished. A knowledge of the nature of the soil therefore must precede any satisfactory design or construction. It is not necessary to allot much time in the curriculum to this subject since a fair knowledge of chemistry, physics and general geology will enable the student to "read it up" with ease, but its importance should be emphasized in the mind of the embryo highway engineer.

A general course in economics is the necessary part of an engineers training and the highway engineer should be made familiar with the subject of trade and transportation as a whole, and with highway transportation as a special field. He should also become familiar with methods of financing highway construction such as bonding, general and special taxation and the like. He should have some knowledge of the laws governing the inauguration of public work, the advertising for bids and the letting of contracts, the guaranteeing of quality and the essence of contracts.

It is of interest and value to the highway engineer, but probably not essential, that he should be familiar with the historical development of the subject of highway construction. If he is to carry weight as an advisor in public matters, the possession of historical perspective could not fail to give emphasis and support to his expressed opinions.

Finally he should have opportunity to make special study of road materials in the laboratory. Sands, cements, mortars, stone for road metal, bituminous materials and all other substances that go into the construction of highways should become more or less familiar to him through actual manipulation.

Now all these various lines of study as above recited, should not require any great amount of time if the student has previously been given a fundamental training in the subjects mentioned. Since practically all the civil engineers in the schools of the country are trained in the elements of surveying, chemistry, geology, economics, history and materials of construction, the additional training needed, as outlined above, can no doubt be included within a total of two or three credit hours for two semesters or four to six credit hours in all. A credit hour means a lecture, recitation or laboratory period per week for the half year. Actual practice in the schools varies very widely throughout the country as shown by the following tabulation.

Table Showing Time Devoted to Highway Engineering Instruction in Various Universities of the United States

NAME OF SCHOOL	LENGTH OF COURSE	TOTAL CREDIT HOURS HIGHWAY ENGINEERING INSTRUCTION	
		Required	Elective
Columbia.....	5 years	2	16
Cornell.....	4, 5 and 6 years	1	
Illinois.....	4 years	2	
Michigan.....	4 years		3
Minnesota.....	5 years	3	
Missouri.....	5 years	2	2
University of Wash- ington.....	4 years	2	4
Wisconsin.....	4 years		4
Yale.....	5 years	2	

THE CHAIRMAN: We will now listen for a few moments to Mr. Phil Mitchell, from Illinois.

MR. MITCHELL: I came down here in connection with my associate Mr. Woodcock, who is Secretary of the Rock Island County Highway Improvement Association, of which I have the honor to be President, to learn something at this meeting. We make no pretense to scientific knowledge of roads. We know that in our county we have very poor roads and we are ambitious to improve them. Rock Island County is comparatively a small county in area, but it is a rich and fertile county with a population of about 75,000. I merely wish to state what we have attempted to accomplish in our community toward getting good roads. We made a vigorous campaign, we visited every township in the county and argued the issue of \$1,000,000 worth of bonds for the construction of 131 miles of roads which had been selected and designated by our Board of Supervisors, and nobody as far as I ever heard, objected to the roads that were selected. They were deemed a wise selection. Our object was to provide ways and means of building those roads. When I was elected to the Presidency of this Association, I was appalled by the magnitude of the proposition. I did not see how anything could be accomplished and thought we would simply go as we had been going for the last 50 years, electing incompetent road commissioners or supervisors, one of whom would plow a ditch on one side of the road and turn over a little soil there and then the next commissioner would come along and turn it back again. That is about the way we had been going along in the past. We made an earnest effort in favor of these bonds of a million dollars which were made legal. It was made possible to legally issue them by means of the Tice Law which our good Chairman here, who is a member of the Illinois State Highway Commission and Mr. Bradt, who is also here, can tell you more about than I can. I wish to say in this connection that both these gentlemen and the other

two members of the Illinois Highway Commission gave us most efficient assistance in our campaign, coming to our meetings, not arguing particularly for any special bond issue, because that was out of their province, but giving us information as to the kind of roads we should have and how they could be gotten. I am very sorry to state that we were unable to succeed in our campaign and we feel as though we were stabbed in the back by the efforts of our Board of Supervisors. We have 35 members of the Board in our county, and when we presented this proposition for bond issue before them, after it had been thoroughly discussed and canvassed and published throughout by the papers in every township in the county, we went before them and asked for this million dollar bond issue and they went into secret session and then beat the proposition. Now the only question we wanted was for the Board of Supervisors to agree to leave this proposition to the people, and if it had been beaten at the polls, of course, we would have submitted with good grace. But we did not submit with good grace to the manner in which it was withheld from the ballot. There is no sentence the great Lincoln ever uttered probably that has been quoted oftener than this, "Government of the people, for the people and by the people." That was all we asked in this proposition, that the people should pass sentence on whether we should or should not issue these bonds, and we were deprived of the privilege of voting on that proposition, but our Association is still very much alive, as evidenced by the fact that Mr. Woodcock and myself are both here to seek information along lines leading to the ultimate construction of 131 miles of good roads in Rock Island County. Now the cost to the farmers there was comparatively little. I have a farm and it would have cost me \$10.82 a year on the first year for these bonds, which would provide for the issue and retirement of \$50,000 of bonds every year and gradually that tax would become less; probably it would not become less in a way because the building of 131 miles of roads in our county would be such an object lesson that the work would be extended and we would get more roads, but that is what we attempted to accomplish.

THE CHAIRMAN: Is there any further discussion? Remember the annual banquet this evening at the Kimball House. You can secure your tickets at the office. This completes the program for the morning session, and we will now take a recess until 2 p.m.

November 10, 2 p.m.

MR. PAGE IN THE CHAIR

THE CHAIRMAN: Gentlemen, in the movement for better roads throughout the United States, we have experienced a great many vicissitudes. One of the greatest drawbacks, in my judgment, which has confronted our work, has been petty politics and a poor selection of the proper man to take the responsible positions. We all

remember a few years ago, when politics throughout the country changed, there were six States in the Union whose change of the political parties brought about almost a complete change, in even the technical positions in the Highway Departments of those States. Men that had had years of experience in engineering work and had learned local conditions and become of real value to the public were thrown out of office simply because of their affiliations with a certain political party. Now in the government service we are absolutely free from politics as far as our road work is concerned, and I think that Mr. Wales, who represents the United States Civil Service here, will tell you that there are few of our engineers who would take the positions they do, at the salaries the government pays, unless they were assured that we were free from politics. We have this afternoon the coöperation of the United States Civil Service Reform League which has done so much to apply the merit system to public service work. There is no branch of public service work where we need the coöperation of the Civil Service Reform League more than in the work of bettering our roads, and it is my great pleasure to introduce Mr. Richard Henry Dana, President of the National Civil Service Reform League, who will preside this afternoon.

Mr. Dana takes the Chair.

THE CHAIRMAN: *Mr. President, fellow citizens and members of the Congress:* The subject of my address this afternoon is how to take the roads out of politics.

HOW TO TAKE THE ROADS OUT OF POLITICS

BY RICHARD HENRY DANA

President, National Civil Service Reform League

The chief motive that impelled civil service reformers to devote their energies to the adoption of the competitive merit system for government appointments was to diminish the power of the political boss by taking out of his hands the unrestricted patronage of appointive office. The so-called "spoils" system was not only injurious to the efficiency of the government but it created an army of political workers, thus building up an enormous political "machine," active in politics all the year round and often opposing the interests and wishes of the people at large. Before such an army of trained, disciplined, well-generated party workers, paid out of government funds, the ordinary citizen was as helpless as a mob in the face of a regular army.

What about the size of this army? Altogether, counting the federal service and that of all other branches of government—city, county and State—within the United States, the total number of

persons is over 800,000 and the total salary something like \$700,000,000 a year. But for civil service reform this would all be an enormous political standing army, and this stupendous annual sum of money would be all used to influence primaries, caucuses, conventions and even elections. Hardly more than one-third of this army and salary is controlled by civil service rules and laws. The rest is in politics.

The improvement of the civil service was at least in the earlier days considered more as a by-product than as the main purpose of the reform. This by-product has become more and more important as we have advanced. It has been proved officially again and again that the government work is far better done by fewer people when under the competitive merit system than before; for example, in the railway mail service, where careful records are kept, since it has been put under the civil service system more work is done per capita at more than three times the accuracy of the best record ever made before, and five times some of the others. It has also been officially computed that the saving in the federal service alone is about \$20,000,000 a year.

During the first fifteen years of the merit system it was applied mainly to subordinate positions, such as clerkships, policemen, firemen, bookkeepers and the like, omitting the laborers at one end and the higher officials at the other. We have been very slow in extending the system upward. We have extended it sideways so that now we have civil service laws in 9 States and about 250 municipalities; downward, unskilled laborers in the federal service and some cities are selected on a basis of age and relative physical condition so that the laborers are taken out of politics and the public gets young, active and able bodied men. As to its extension upward, we have made considerable progress as I shall explain more fully further on, but for the present all postmasters with salaries over \$1000 a year, all collectors of internal revenue and their deputies, all collectors of the customs and United States marshals, for example, are outside the civil service rules, and the same principle applies in the main to the civil service of those cities and states that have civil service laws. As a result, while we secure better subordinates the head positions, in which the brains ought to be, are usually filled by persons without proper education, training or experience. This is not all. The more capable subordinates finding that promotion to these higher places is shut off from them soon get discouraged and resign from the public service.

Still further, while the boss has been deprived of a large amount of his patronage, he still keeps the best paid offices and, through his power over the heads of city departments and other high officials, is still able to give contracts, jobs, and the furnishing of supplies to political favorites.

It is now one of the objects of the Civil Service Reform League to arouse public opinion so as to compel Congress to allow the higher

postmasters, the collectors, and the like, to be put in the classified civil service, so that such places may be filled by promotion and in general to extend the law upward and thus to take contracts out of politics.

I shall now come to the application of the general principles of the reform to the experts in road construction.

What is the condition of road construction as we see it within the United States? Is there not a great proportion of the work in the control of incompetent persons? Even where good road experts are employed is there not constant interference by their superiors to give contracts as political favors, to enforce too rigidly or not enforce at all the specifications for political reasons, and to do superficial work about election time to deceive the people into thinking that a good job has been done at small cost?

Let me state some of the advantages that come from the employment of experts in road construction. It will save waste from poor plans, poor methods, use of the wrong materials, improper or insufficient sub-drainage, or surface drainage, insufficient foundation, waste in the supervision of labor, loss from insufficient specifications and from failure to enforce good ones properly, the lack of proper super-elevation at curves, causing great wear both on the road-bed and the tires; and the employment of incompetent laborers employed to give influential voters, or friends of active politicians a job at the expense of the public at high pay; and the inability to get a day's work for a day's pay from those otherwise competent men who know that they hold their job not for what they do in road building, but through the political influence of the party boss behind the throne of the road authorities.

The experts, especially the chief experts, hold their office as a rule, do they not, at the pleasure of political superiors or of superiors who themselves, though not active politicians, may be removed for party reasons or are themselves elected officials who look for a re-election which may depend more upon satisfying a political boss or packing a primary than upon securing good roads for the public, and is it not also too often true that the position of the expert is needed to carry out some party plan or complete a factional slate? At all events, the employment is so apt to be temporary and the changes are so often made even when good experts are employed, that continuity of policy is not carried out. Fear of removal and the desire to help those who have given the appointment tends to bring the expert into politics. No permanent career can be offered to younger men who enter from the lower grades of expert work; no hope of promotion to the upper, and as a rule it is hard to get the men of the best ability to leave well-established work with private persons or corporations, for the uncertain and sometimes distasteful work of public employment. It sounds more funny than fiction when we read the truth from this year's report of James W. Osborne, Special Commissioner to investigate the New York State

Highway Department, that the inspectors to pass on contract work were some of them barbers, tailors, prize fighters, bartenders and bakers, and, as might be supposed, that their inspection "was totally inadequate."

But even supposing that the experts from top to bottom are appointed absolutely free from political favoritism of any sort and are men of good ability, their powers are limited. To be sure, some road commission for the time being, here and there, may be found that will not interfere with their experts, but as we have seen again and again, the experts are subject to the direction of the non-expert, political or semi-political boards, or elective officials, and have to submit to the superior authority which can put a joker into a contract; modify the specification; order poor work to be accepted, or good work to be refused on the payment or non-payment of political contributions, or the possession or non-possession of political influence.

As an illustration we have the case of the New York State Road Construction, and nothing was more evident in the investigation than that in many cases the experts were entirely opposed to the action of their superior officers which they had no power to prevent, and it was contrary to official discipline to expose to the public the various methods that were used for giving contracts to influential politicians, or for securing political contributions at the threat of holding up pay for work done.

But someone will say, if we leave road building wholly in the hands of experts with independent tenure of office, we are not having local self-government; we are interfering with the representatives of the people and choking off the expression of public policies. We must admit that if we should make our experts complete despots that there would be a great deal of truth in these objections. Can we not, however, find some line of demarcation between the two extremes? I think we can. The representatives of the people, the policy determining executive or board or legislative body should decide upon the general public policies as to the amount of appropriations, just where good roads are to be built, as for example between which towns and cities, or what general principles of choice are to prevail, but, on the other hand, the powers of the experts should be supreme in the *operative* sphere as distinct from the policy determining. The operative sphere should include the full control of the preparing and awarding contracts and the enforcement of specifications; the control of labor; and the purchase of supplies, and everything else that is necessary for securing the best results at least cost to the community. The community should have a right to say how much they will be taxed and what it is they want done, but beyond that the community will get the best results, will they not, if it will leave to experts, selected without regard to politics and free from the danger of political removal or interference in any way, the carrying out of the details of the plans necessary to accomplish the purposes the public have in mind. The experts too should

be allowed freedom to advise and even educate public opinion as to public policies within their specialties.

We then have to consider the three chief points: first, the selection of experts which will secure from top to bottom experts of ability, experience, and character; second, tenure of office during capacity and good behavior and third, ample powers within the operative sphere. Now for the selection of the experts in any large public service devoted to road building. There should be a system of promotion from among the assistant engineers and other experts that would secure the highest positions when vacancies arise to those who have shown the best ability and achievements, and entrance to these lower positions should be through civil service examinations. Where there is not found among the subordinates anyone suitable for promotion or where the service is new, then it is necessary to go outside. And in such cases there ought to be freedom to select experts from all parts of the country, and an ample inquiry into the sufficiency of education, training, special ability, and the possession of organizing and executive faculty among the candidates. Now how can this be done? The adoption of the Civil Service System would secure promotion but no open competitive examination composed of written questions and answers of the "scholastic" kind would ever be suitable for the appointment of the chief experts in any such undertaking as modern road building on a large scale, but when I have said this it does *not* mean that the experts may not be still selected through civil service methods for the civil service methods are *not confined*, as too many persons take for granted, to the written scholastic examination conducted in the same room and at the same time, such as are used for the selection of clerks, bookkeepers, and the like. Every method known to business for the ascertaining of the relative ability of various candidates that is capable of being systematized, that is, every method excepting that of pure favoritism, can be and is employed by civil service commissions. Bench tests are used for selecting mechanics, physical competition for policemen and firemen; saddling, mounting, riding horses, and firing from horseback have formed part of the civil service examination for United States rangers. For the last fifteen years men of high organizing and executive ability, power to handle subordinates and get on well with men, combined with appropriate scientific knowledge, have been secured for high governmental positions by what is called the "unassembled investigation of careers" conducted by civil service commissions. Though this has been in operation for fifteen years, as I have just said, its existence is still unknown to many experts, statesmen, and I may say to the great majority of our citizens, and it is largely for explaining this method of selection and showing its applicability for the choice of experts in road building that this paper is written. Let me give an illustration.

The office of librarian of the enormous library system of the city of Chicago became vacant. It was found that that position was

classified under the civil service rules. The first idea was that an exception must be made and the appointment authorized at the discretion of the Mayor for the reason, as stated, that it would be impossible to fill the place satisfactorily by any "scholastic" examination. The civil service commission and the civil service reformers of Chicago were well aware of this "unassembled investigation of careers" and how successful it had proved and they undertook to make the selection under the civil service rules. First of all advertisements were sent out over the country and especially to all the journals devoted to library work, and letters were sent to library experts to suggest candidates. It was explained that the examination would not consist of the ordinary sets of questions and answers but that each candidate should reply from his own home or office to a detailed inquiry as to his education, training, and achievements in life. Then three eminent librarians were chosen to aid the civil service commission in this investigation. The three chosen were Mr. Herbert Putnam of the Congressional Library, Washington, D. C., the head of the Crerar Library in Brooklyn, New York, and the librarian of the University of Chicago. These men aided the civil service commission and their chief examiner in drawing up the questions on the experience sheets sent to the various candidates. The candidates were also asked to send in any book, pamphlet, or paper prepared by them on library administration or kindred subjects and to give the names of persons for whom they had worked, who would know of their successful administration. Then, after weeding out those who from their own statements were manifestly unfitted, there were sent to these former employers searching questions which were answered in detail showing any facts tending to prove the possession by the candidate in question of executive and organizing ability, any unusually successful work accomplished, the possession of such temper and manners as would enable the candidate to get on with other people, and the ability to handle subordinates to advantage. Each candidate was also asked to prepare a thesis on the management of the Chicago library system, and to aid him in understanding the situation he was furnished with the latest official reports of Chicago relating to the library and the municipal budget and resources. These theses were prepared at the homes or offices of the candidates and sent to the civil service commission. As a result of all this investigation and the examination of these records by this jury of three great experts, Mr. Laegler was put first. As the civil service records, thus prepared, showed, he had been librarian at the Wisconsin University; had there instituted some methods of library administration of such value that they were being copied by other libraries all over the country; had, when in another capacity, practically organized the splendid university extension work and public aid given by the University of Wisconsin; had gone before committees of the Legislature and explained his methods and secured appropriations; and had been able to train

his subordinates so as to get the best possible results. Indeed, as Mr. Putnam said to me, there was no better man that could be found in the country not already occupied in some better position. In some of the non-assembled investigations, the candidates are questioned orally by this expert examining board and further graded on personality.

Now let me call your attention to one or two matters. Through this method there was secured what every appointing officer should secure, that is, a thorough investigation into the capacity of all the candidates, but a kind of investigation carried out with a degree of thoroughness that we know is not exercised by appointing officers even when they are free from any political motive and desire to secure the best results, not even by most business men or corporations. Indeed, the art of appointing the best from a large number of persons for responsible positions is, by no means, as simple as one as many people suppose. Again, all the evidence on which the selection is made is a matter of record, so that at any time the grounds of selection may be reviewed; an effective guaranty against favoritism, and the appointment is made without the appointee's being under obligations to any party, party faction, or political boss; and finally when once appointed in this way the tenure of office is practically secure because the motive otherwise existing of removing an expert, namely, to give the appointment to a favorite, has disappeared, for the appointment of a successor must be made in the same way that the original selection was made, or else by promotion from a limited number of persons who have secured their positions by open competition. Then again, when the position is thus put under the civil service system and the tenure of office is secure, instead of keeping able men away, it is found by experience that it has attracted them. It has commonly been said that you can not get able men to enter the civil service examination, but in the words of the United States Civil Service Commission commenting on the results of such civil service investigations in its twenty-ninth report:

Examinations of this character have been found to attract men of the highest type. A belief in many quarters that no distinguished expert or person of high professional or scientific attainments will compete in a civil service examination is a fallacy.

This has also been the experience of municipal and State civil service commissions that have tried the system.

At a hearing of the Legislature in Massachusetts on a bill to allow heads of departments to be selected in this manner, Professors Swaine and Sedgewick of the Massachusetts Institute of Technology said that they usually advise their graduates not to accept public work, because it is so mixed with politics, but should these positions be put under the civil service system and carried out in the way above explained, they, on the contrary, would urge all their graduates to enter this kind of public service.

Another objection has been made that there are not sufficient experts in the country to fill all the positions in the road construction that is going on. However that may be, we can secure all the experts there are who are willing to undertake the work, and if one will just read the catalogs of the leading universities of the country, he will see that more and more time is given to the education of experts in all kinds of municipal and State undertakings, among which road building is one of the most commonly taught. The supply of young men who can be put in the lower grades of expert work and make their way up, through promotion, is very great.

Some objection is raised, on what is really *a priori* and theoretical grounds, that experts with tenure during good behavior and capacity, would not accept new policies. In practical operation, exactly the opposite is found to be the case. Not only do such experts take kindly to new policies, but they are foremost in suggesting and urging them. The expert is far more well informed as to new devices adopted in any part of the civilized world and to weigh the merits of them, than the non-expert.

I remember, not long ago, delivering an address before a club of business and professional men as to the application of the merit system to the selection of high-grade experts. I saw one prominent man before me with his face set in stern disapproval from the beginning. After the address, he made the remark that "it is absurd for anyone to suggest selecting men for such positions by a scholastic examination of questions and answers," and wondered that "a man of my position should advocate it." The truth was this gentleman had shut his mind up into idea-tight compartments, proof against the percolation of a new thought. It is this state of mind which prevents many people from examining into the civil service method which I have just now laid before you.

But after all the best proof of the pudding is in the eating. If this were all a matter of theory which had never been tried before, or perhaps only in one or two instances, I should blame no man for considering it highly theoretical, just as old sea captains and river steam-boat navigators thought it was impracticable to cross the Atlantic Ocean in a vessel propelled by steam. Should any such captain continue so to think after the ocean had been crossed many times every year for fifteen years in succession with success and improved speed and economy, ought not that captain to be considered antiquated indeed? So it is with anyone who doubts the applicability of the civil service system to the selection of engineers unless, indeed, he is absolutely ignorant of how often we have crossed the ocean of spoils politics in safety by the advanced methods of the merit system.

The first position to which it was applied, about fifteen years ago, was that of the supervising architect of the United States, a position of the very greatest importance and high salary. Then it

was successively applied to the selection of the heads of many of the Bureaus, especially those of the Agricultural Department, for which positions men of high scientific education in their specialties and executive and organizing ability were required, and the success with which these departments have been established and carried out is the best proof of the applicability of the system. Among other positions I may mention that of the head of the United States Bureau on Road Building and Road Materials.

In the city of Los Angeles the enormous water supply that was to cost many millions was put into the hands of engineers selected in the ordinary way. The work was going to pieces, little was accomplished and an enormous amount of money had been wasted. Then the board in charge was re-organized and all the engineers from top to bottom were selected by the civil service system, and after that the work was accomplished rapidly, economically, without taint or fraud, and with the most complete success.

Even assistants to the attorney-general at Washington and assistant solicitors and attorneys in States have been selected in this same way; also the chief engineer of the city of Chicago, engineer in charge of bridges, city auditor, the chief street engineer, the building inspector in chief, and numerous other officials with salaries from \$5000 to \$8000 a year, and lately in Philadelphia the chief engineer and his assistants for the new subway development and other experts with salaries even as high as \$10,000 a year, the heads of departments, with one or two exceptions in Colorado, the secretaries and chief examiners of civil service commissions in several States have also been chosen by this same process.

The division engineers in the State of New York who are required to have charge of the construction, re-construction, maintenance, and repair of State and county highways are now under the civil service system with the full approval of Commissioner Carlisle.

In Kansas City the chief engineer, the assistant chief engineer, the superintendent of streets, and some other positions have been appointed through competition, and in New York City the chief engineer of the board of estimate and appointment is under the competitive merit system.

Indeed, these are only some of the many examples which I could give you. In addition to that, I may quote Lieutenant James Reed, assistant director of the department of public works of Philadelphia, in a paper read at the last meeting of our National Civil Service Reform League. He not only commended this method of selection as having worked with perfect success, but he also showed and proved that by this method of the selection and retention of experts, the municipal contracts had been taken out of politics in Philadelphia—that city long known as being under the domination of political contractors.

Some objection has been made to the merit system because of an alleged difficulty in removing a classified employee. We claim that

it is generally easier to remove for good cause under the merit, than under the spoils system. Under the spoils régime, an employee put in by political influence often could not be removed by his official superior even for drunkenness and insubordination. The superior who tried to remove him would usually find him re-instated, or his own official head in danger of coming off. It was easy enough to remove after a change of party or party faction—too easy for both good and bad were turned out. It is only in the New York City police force that removals for cause are difficult. There, against the opposition of the National League and the New York Civil Service Reform Association, an appeal to the courts with a complete revision was allowed, but elsewhere the usual rule requires only a statement of the reasons for removal in reasonable detail to be given the employee, with a chance to answer in writing, just to avoid removal under a mistake as to the facts, but the appointing officer has the final power.

Fixing of the powers of these experts is a matter of legislation and not of civil service reform, but at the same time, the selection and retention by the civil service method will give them such independence of position, such freedom from any question as to how the next election is going, and such absence of control by politicians that any powers granted to them by law can be exercised with an amount of independence which would be impossible without the tenure that the civil service system gives them.

It is true that some of the experts in German cities, in the city of Paris, and in the cities of Great Britain are not strictly under civil service rules, but they are under restricted methods of selection, partly from custom and partly by statute law very closely allied to the system that I have just explained, based on competition and the possession of education and experience that produces practically the same results by methods which are first cousins to the civil service system, and I need hardly say how vastly better and more efficient is municipal administration in those municipalities in which all the operative work is in the control of these prominent, highly trained, and efficient experts.

In the national government of Great Britain all the experts of that board that has control of municipalities called the "Local Government Board," and the permanent heads of all the great national departments, such as the treasury, postoffice, foreign affairs, and the like are strictly under the competitive civil service rules.

It is important that the civil service commissions should themselves be free from political considerations. Besides having their chief examiners, secretaries, and other subordinates under civil service rules, the plan of having the civil service commissioners appointed for long tenure, say six years, with overlapping terms is recommended and in some cases already adopted.

Lastly, may not the plan of having all the governmental work in the control of high-grade experts, free from politics, be the final

solution for securing efficiency and economy in public undertakings? May it not be the anti-toxin for public waste and corruption? May not the great success of the United States army engineers in the harbor and river work and in the Panama Canal be because these army engineers are so free from political pressure and have so secure a tenure of office, rather than because they are superior as individuals to the civil engineers of our country?

If there be any truth in these ideas, is this not a cause well worth promoting with all our influence, patriotism, and enthusiasm, not only in road building but in all other governmental enterprises?

SUMMARY

For fifteen years civil and sanitary engineers, architects, physicians, superintendents of streets, chief librarians, heads of bureaus, etc., men of scientific or special training and executive and organizing ability and high professional standing have been obtained through the civil service examinations. This is possible because those "examinations" consist, not of the scholastic questions and answers used for clerks, but of inquiry addressed to the candidates and to those who have employed them as to what education, training and experience they have had, their achievements in life and manifestations of executive and organizing ability and power to get on with and handle men. This inquiry is conducted by the aid of appropriate specialists of high reputation. To the inquiry is added a thesis on the conduct of the work to be done and sometimes an oral interview to ascertain personality. Such up-to-date methods form the clue for "taking the roads out of politics."

THE CHAIRMAN: The next paper will be on "The Sound Administration of Public Service," by the Chief Examiner of the United States Civil Service Commission, whose actions we, as a league, have watched and have never once found fault with him, but he has secured our admiration as a man who is constantly pressing forward new ideas for the benefit of the public system. I take pleasure in introducing Mr. George R. Wales.

SOUND ADMINISTRATION OF PUBLIC SERVICE

BY GEORGE R. WALES

Chief Examiner, U. S. Civil Service Commission

Any mention of the subject of road building brings to my mind recollections of boyhood days on a farm in Vermont. There we had in operation a system of road building which was an excellent example of the way not to do it. It was supposed to be a system of road construction, but it was actually a system of road destruction. I am told that this system, with slight modifications accord-

ing to locality, is still is vogue in many parts of the country. Doubtless you are familiar with it. A road tax was levied against each farmer, and he had the privilege of paying the tax in cash or of working it out on the roads. Cash being scarce, and time plentiful, the farmers unanimously decided to work out, rather than pay up. So a day was set aside for a road building bee. But it was a day of celebration and jollification instead of a day of hard labor for the public good. It was a holiday set aside to celebrate the highways. Like Thanksgiving and Christmas and the Fourth of July, it was a day of joy and good fellowship. Everybody had a glorious time and the road taxes were charged off the books.

But there were a few zealous, well-meaning souls, who were conscientious in their performance of their public duty and who felt that the other taxpayers were only cheating themselves by failing to give an honest day's work. These faithful ones brought forth their teams and, with plow and harrow and scraper, diligently fixed the roads. Oh yes, they fixed them. They fixed them so that the mud in wet weather and the ruts in dry weather were deeper and more plentiful then before.

No argument is needed to convince the members of this Congress that road construction should be placed in the hands of trained and competent men. There was a period in the history of our country when it was necessary that the settlers and farmers should build their own roads on which to haul their produce to market. In those days farmers and their wives were obliged to do many things which they can now have done for them in an infinitely better and more economical way.

There is another system of road construction which is, to say the least, equally as inefficient and much more extravagant than the one whereby the farmers build the roads for themselves. I refer to a system whereby road construction is made the prey of political favoritism, either local, county or State. We cannot have good roads, constructed and maintained economically, if their construction and maintenance are to be influenced by political expediency. The work must be divorced absolutely from political considerations and put upon a business-like basis of efficiency.

I am told that with the exception of two or three States the work of road construction and maintenance in this country is being parceled out, not to those who have the ability to perform it properly, but to those who have the ability to control a few votes. One of our leading periodicals recently characterized this system as a species of graft. Perhaps a more precise term would be highway robbery—the system robs the people of their highways and their money at the same time.

A plan has been proposed by members of this body whereby each State may take its road building operations out of politics and place them under a proper system of administration—an administration which will insure to the people one hundred cents' worth of road-

way for every dollar expended in taxation; an administration which will place the building of the roads in the hands of technically trained experts who have made this science their life work; an administration which will enable the people to realize all those great benefits in education, prosperity, and improved country life that will result from an adequate system of modern highways. Briefly, the plan is for each State to place general supervision of its roads in a non-partisan board, that is, a bi-partisan board and hence non-partisan in its action, under whom there shall be a State highway engineer with assistants and a highway engineer in each county, or a group of counties when a single county cannot afford to have an engineer, all of these engineers, from the State highway engineer down to the county engineer, to be appointed from those graded highest in a competitive examination testing the qualifications of all applicants for the places, and all of them to hold office during good behavior and efficient work.

A little over thirty years ago the national government established a system of competitive examinations for filling appointive offices. Before that time appointments were based almost entirely upon political considerations, ability to do the work being a secondary consideration. Upon a change of the party in power it was the practice to turn out those in office, whether or not they had in their period of tenure learned to do the work, and to put in their places a new lot of incompetents. The people tired of this farce and demanded that competition for appointment should be upon the basis of ability to do the work, instead of the ability to get votes. I do not wish to be understood as claiming that every individual appointed under the patronage system was incompetent. There were just enough exceptions to prove the rule. Spurred by a mighty insistence from the people, Congress enacted a law, calling it "An Act to improve the civil service of the United States." It provided that appointments should be made according to grade from among those graded highest as the result of open competitive examinations, and that the examinations should be practical in their character, designed to test the capacity and fitness of applicants to perform the duties of the positions to which they sought to be appointed.

At first the competitive examination system was applied only to a comparatively few positions, mostly of a clerical character, numbering less than 14,000. But the law gave the President power to extend its operations to other positions, and from time to time the Presidents have extended it, so that now it covers almost all the positions in the executive branch of the government to which appointments are made without the advice and consent of the Senate. The extensions have not been confined, however, to presidential action, for growth in the government business and extension of its operations and investigations to new fields have gradually increased the number of persons who hold office under the competitive system in the service of the United States. At the present

time approximately 300,000 positions are classified under the national civil service law.

It seems to me that this growth in a period of about thirty-two years is alone sufficient proof of the efficiency and absolute success of the system. We have, however, the direct testimony of men who have been in position to know the facts—those responsible for getting out the work—that efficiency has taken the place of inefficiency, and economy has taken the place of extravagance, wherever this system has been applied; that the volume and accuracy of the work done by each employee have increased amazingly. We know from the records showing the number of pieces of mail handled by each employee of the railway mail service that in that one branch of the government's work the competitive system is saving to the taxpayers several millions of dollars annually and at the same time handling the mail with a marvelous increase of accuracy. To be more exact, the figures show that each employee is doing 20 per cent more work than under the old system and doing it with one-third the number of errors. Again, and as further proof of the success of the competitive examination system, it is found that in those parts of the service where efficiency ratings have been made, there is an almost exact ratio between such ratings and the ratings received by the employees in the examinations through which they were appointed.

It is not my claim that the operation of the civil service law is, by any means, absolutely perfect. The law was humanly devised and is humanly executed. I do not believe the civil service system has a little millenium of its own which it has reached or will soon reach; but the law will compare most favorably with any other federal statutes in its shortcomings, which are rapidly lessening with the increase of public confidence in the sincerity and efficiency of its administration. It has seemed to me that some of the friends of the civil service law have had a mistaken attitude toward its operation and administration in respect to violations of the law. Utter amazement and discouragement is evinced by some person at a single violation of the civil service law, when frequent violations of other statutes are regarded with complete equanimity and indulgence and are taken as a matter of course.

Some years ago a clergyman, who happened to be also a very impractical man, came into the office of one of our commissioners showing great excitement and perturbation and exclaimed, "Mr. Commissioner, I find that your civil service law is actually being violated; you are actually not preventing violations of it."

The Commissioner glanced at the clergyman's card and replied, "I see by your card that you are a clergyman. Let me ask you a question. How are you getting along these days in enforcing the law of Moses; any violations?"

But I wish especially to call your attention to the development of the competitive examination method of appointment to profes-

sional and technical positions, positions of responsibility paying up to practically \$5,000 a year—in other words, that class of positions comparable to the kind required for efficient highway administration. It was not until 1896 that any considerable number of such positions were brought under the system, and even at that time the number was small as compared with the number and variety of such positions now included within the operation of the law. It has been claimed that the success of the competitive system as applied to professional, scientific, and technical positions has made possible the great extensions which the government has made in recent years in scientific experimentation and investigations for the public welfare. However that may be, the increased activities of the government in these lines have necessitated the application of correct principles of competitive examinations for such positions in order to insure the success of this system of appointment. The Civil Service Commission has simply been careful to apply common sense business principles to its methods of examination. If a position of a technical character requires a man with technical training without much, if any, additional experience, the examination has been opened to those who have had the required technical training, and they have been given written tests in the subjects with which they should be familiar in order properly to perform their duties. If the position requires a man who, in addition to a technical education, has achieved distinction and has become eminent in the line of his profession and who perhaps has specialized in some branch of his profession—one competent to devise, lay out and manage the work—then the examination has been so constructed as to bring men of that character to the head of the eligible list. An examination consisting of questions and answers on technical subjects would not be likely to determine the relative fitness of applicants for such a position; moreover, men qualified for such a position could not be expected to enter into an examination of that kind. Therefore, for these high grade positions where men of experience and attainments are needed, an examination is given which does not require the competitors to assemble at any place or to answer technical questions. They are called upon to furnish, under oath, a detailed statement of their education and experience, including all the work they have done since graduation. They may also be asked to submit an original thesis or published works, and they are required to give the names of persons able and competent to testify as to their experience and personal fitness. Confidential inquiry is made by the Commission from various sources as well as of all persons referred to by the applicant. Gratifyingly accurate and discriminating testimony is obtained by this means of confidential communication. Such testimony approximates, if not equals, the testimony adduced upon cross-examination in judicial proceedings. The Commission has on its force of examiners men skilled in the weighing of evidence of this kind. It has a corps of expert examiners who are eminent and

leading authorities in their respective lines, whose services may be called in when needed. With such means it is not difficult to place upon the history of the career and accomplishments of each applicant a percentage rating which is an accurate measure of his relative fitness to perform the work to be done.

A demonstration of the ability of the competitive system to obtain high class men for technical positions has been made within the past year, in connection with the employment of men to appraise the value of the property of common carriers in the United States. For this work the Interstate Commerce Commission required men with qualifications ranging all the way from rodman and chainman to the senior positions in civil, mechanical, structural, electrical and architectural engineering, as well as motive power men and expert accountants. There have been approximately 15,000 applicants for these positions, and the task of sifting the wheat from the chaff and of grading the wheat after the sifting was one of considerable magnitude; but it was done, and it was done so well that the Interstate Commerce Commission expressed its gratification to find that it could secure a force so well equipped to perform the gigantic task of obtaining an accurate appraisal of the value of common carrier property. A system which can successfully secure a competent force of high grade engineers for this valuation work could surely provide the proper kind of men to have charge of the construction and maintenance of public highways.

A large number of other instances could be cited, demonstrating the absolute success of the competitive examination system when applied to highly expert and technical positions. Among such positions are, assistant director of the Office of Public Roads, senior highway engineer, assistant in road economics, petroleum engineer, chemical engineer, mineral technologist, chief metallurgist in the Bureau of Mines, associate physicist in the Bureau of Standards, professor of chemistry and professor of pharmacology in the Public Health Service, assistant chief of the Bureau of Chemistry in the Department of Agriculture, chief irrigation engineer for the Indian Service, experts in the Children's Bureau, and many others, all ranging in compensation up to \$4,800.

The competitive system has grown in States and cities as well as in the national government. It has grown in the extent of its operations and in popular favor as well, and it is constantly gaining friends as the people come more and more to understand its principles and to appreciate its benefits. It has now become so strongly entrenched behind public sentiment that partisan administrative officers are afraid to admit that any changes they may make are influenced by political considerations, and are careful to claim at least that all such changes are for the purpose of improving the efficiency of their officers. Wherever the adoption of the competitive system has been submitted to a referendum vote, it has come out victorious.

The States of New York and Massachusetts were among the earliest to adopt the system for appointment to State and county offices. New Jersey has, within recent years, put it into operation in much the same comprehensive way that it has been established in Massachusetts and New York. These three States, I am told, are leaders in highway administration and they can be taken as examples of what the competitive examination system will do for the good roads movement.

This great organization of representative men from all parts of our country can do much toward increasing the popular understanding of what the competitive system is and what it accomplishes. That there is a need for a still wider popular knowledge of it is shown by the need for its application to the good roads movement in the States where it has not been applied.

In its beginning the competitive examination system was largely, if not entirely, a system of entry to public employment, coupled a little later with tenure during good service and good behavior. Latterly it is broadening definitely into a system of administration. A civil service commission today might more properly be designated a department of administration. Only through the administration of a civil service commission is it possible to have the most efficient and economical management of all the various departments and branches of the public service. It is essential, however, that the conception of public positions as patronage be displaced by recognition of the fact that public business at all times is the business of all the people. Public positions should be held in trust for all the people. With this purpose the competitive examination system is particularly in harmony, for it opens the door of the public service to the competent and worthy and closes it effectually in the faces of the unfit and the unworthy. This system is needed wherever public business is to be done.

THE CHAIRMAN: Gentlemen, I noticed in the discussion this morning something was said about the power of removal, and a good many people who, sometimes from political motives and sometimes from ignorance, have tried to make out that it is impossible or hard to remove a man from the civil service that is classified under its rules. Let me state that experience has shown that it is easy to remove a man for good cause under civil service rules. Those of us who have watched the civil service for years back have seen many instances of persons who have been dismissed by the official in charge for drunkenness and insubordination, for example, and had that person put back again by some political superior, so that the man directly in charge of him no longer had any control over his actions. Under the civil service system, all that is required in the national service and as far as the national league has ever approved of, has been that the party to be removed be furnished with the reasons in writing, sufficiently explicit for him or

understand them, and be given an opportunity to reply in writing, with the appointing officer in the end making the final decision, merely to prevent the head officer making the removal from acting under some misstatement or misinformation. We will now pass to the next paper, "The Applicability of the Merit System to the Engineering Service," and may I state that the reader of this paper is now the Chief Examiner of Philadelphia and was appointed as the result of this very kind of competitive examination. He had been the Chief Examiner of Kansas City and his record showed such splendid work that he stood at the head of the eligible list, and exemplifies today an expert receiving his position by strict competition. He is one of the best chief examiners that we have in any of our municipalities—Mr. Arthur M. Swanson.

THE ADAPTABILITY OF THE MERIT SYSTEM TO THE ENGINEERING SERVICE

BY ARTHUR M. SWANSON

Chief Examiner of the Philadelphia Civil Service Commission

It would, no doubt, be interesting to you men who are practical road builders to know how we choose our laborers and skilled laborers for work on streets by the merit system. Take common laborers: We receive applications at any time, then when there is a need for more laborers on the street we notify perhaps a thousand men who have applied to appear in groups before the physicians who are on the staff of the civil service commission. They are given a sort of inspection by these physicians simply to see that they are able-bodied men, their lifting strength is tested, and their eyes, ears, heart and lungs are given a fairly close inspection. The physicians then group the men in four classes. The first class is marked 90, the second class 80, the third class 70, the fourth class, which would be the ineligible, are marked 60. The appointing officers then are required to appoint these laborers in the exact order of their standing on the eligible list. Suppose we need pavers, for example, the applicants are taken to one of the yards of the Highway Bureau, usually to the yard where the bureau would like to have some paving done, and the applicant is supplied with the necessary materials and tools and a helper is required to pave for, perhaps, an hour or an hour and a half, and we have present a practical paving foreman from some private corporation to assist in passing judgment on the men.

However, I wish to confine my remarks principally to examinations for engineering positions of a somewhat higher character and I shall take up and discuss two or three such positions.

Chief Engineer, City Transit. This position pays \$6,000. The incumbent has charge of all engineering work pertaining to the

construction of the great subways and elevated lines now being undertaken by the city of Philadelphia. Our idea is that a written examination upon technical problems is unsuited to an engineering test of this grade. We believe in adopting as nearly as possible under the laws the method of selection which the head of a corporation would probably use. Of course, public positions cannot be filled in altogether the same manner as private positions may be for the reason that every citizen has a right to compete for the public position if he desires to do so. We first selected an examining board composed of the assistant chief engineer of the Pennsylvania Railroad, an engineering professor in the University of Pennsylvania, and a private consulting engineer. An announcement was then issued stating the character of the position, the type of man wanted, and the conditions of the test. These conditions were that the applicant should first submit a complete statement of training and experience, together with copies of any papers or books he had published. This statement of training and experience involved age, education, previous employments, work designed, supervised or constructed, membership in engineering societies, papers or lectures published and other pertinent information and professional or business references. All who received a rating of 70 per cent or more on that subject were admitted to the remainder of the test, which was an oral discussion of appropriate engineering topics with the examining board, after which a second mark was given. These two marks were averaged for the final standing of the competitor, 60 per cent being allowed for training and experience and 40 per cent for the oral test. An engineer of excellent standing, who had previously designed some of Philadelphia's noted public works, among them the famous Walnut Lane Bridge, was the successful competitor in this test and was appointed. There can be no doubt that successful professional men, including engineers, hesitate to submit to a civil service examination as that term is popularly understood. The word "examination" conjures up visions of cramming volumes, and puzzling queries upon text book theories. But the modern merit system is none of this. The effort nowadays is to devise a type of test that is adapted to the job to be filled and one that will attract successful engineers by the sheer fairness of the plan as well as repel the unsuccessful by the hopelessness of its miscarriage through their success. We feel that the test above described did measure up to the job and it produced a successful engineer.

District Surveyor. This position pays \$4000. The incumbent is in charge of all city planning within his district, including streets, sewers, parks, and all similar things. He is not necessarily an executive, but rather a technical man. Again we started by selecting a board of special examiners similar to the one described above. They divided the examination into three parts, namely, experience 30 per cent, thesis 40 per cent, oral interview 30 per cent. Only

those who attained 70 per cent on each of the subjects of experience and thesis were admitted to the oral test. Applicants were not assembled at any time. The experience questions and the subject for the thesis were widely distributed among engineers and applicants were given about thirty days in which to prepare and file their work. This means that the candidate had at his disposal all his usual references and other equipment and made the test a matter of actual engineering practice.

The subject for thesis is worthy of mention. It consisted of a contour map of a proposed addition to a city, with the following instructions:

Prepare a development plan on tracing cloth, of the 126 acre tract "Rockland," on which shall be shown the best arrangement of streets, as determined by a consideration of all the conditions given in these directions and otherwise expressed on the topographical print.

Place upon the plan: (a) The street widths. (b) The two main dimensions of blocks as determined by scale. (c) Elevations of the intersections of center lines of all streets, and all points on center lines where there are important breaks in the grade. (d) Indicate the gradients. (e) The names of all streets. (f) Show lot divisions in each block indicating the principal dimensions. (g) Number the blocks. (h) Indicate the water distribution system with kind and size of pipes. (i) Consider sewerage and storm drainage. (j) Show the drainage system or systems on the plan, give the sewer sizes and gradients and construction. (k) Indicate the paving or wearing surface for each street.

Prepare a Report and Recommendations: (a) Showing and explaining the reasons for the proposed development. (b) The explanations to cover the street and lot systems. (c) The sewer and water systems, explaining in some detail as to the sizes, gradients, street widths and locations. (d) Explain the maximum and minimum gradients of streets and sewers. (e) Explain the sewer depths. (f) Explain the selection and construction of the pavements recommended. (g) Explain the special features in the design that particularly add to its value.

Conditions That May Influence the Development: Location—farming and grazing district; about one and a half miles from a busy town of 75,000 population. The next nearest town is the county seat. Nearest railroad station two miles on double track road. A few suburban streets are proposed for the area on the south side of the railroad opposite the easterly end of "Rockland." Two or three small houses are near the iron works, and about 400 feet south of the railroad. Iron works are about 200 feet south of the railroad, employing 200 hands. Consider rainfall only on the area of the tract, at the rate of 6 inches per hour for the first twenty minutes of cloudburst. Small springs on tract of no account for water supply. Nearest water is a mountain stream about 1500 feet south of the railroad, flowing about 200 cubic feet per minute, of a slightly turbid water. All the region about the tract is of a clayey soil. The area to the south of "Rockland" is mostly flat with a slight slope to the river; nearly open ground.

Computations to be Performed as a Part of Thesis Work: Block "Norfolk"—Compute and indicate the dimensions of all the lot outlines to the nearest one hundredth of a foot, and all other dimensions needed to complete the calculations of the subdivision. Indicate all the courses and distances so that the block and lots can be correctly laid out in the field. Present the individual calculations for all the work in neat schedule form, so that the examining board can inspect readily. Place the results of the computations upon the print in black India ink.

I might add that affidavits were, of course, required as to the originality of the plan and its execution. Eighteen engineers com-

peted, of whom four were finally passed. It may be interesting to state also that the oral interview consisted largely of further explanation of the plans by the competitor and also a series of questions upon the ethics of engineering. I think we are often unmindful of the necessity that the ethical side of the situation be stressed by an examining board in the case of an important public position. The director of public works added his apparent approval to the test by appointing the first man on the eligible list. This illustrates what may be considered another successful adaptation of the merit system to the job to be filled.

Draftsmen. Tests for the engineering service acquired a questionable standing in the minds of many by their very insufficiency in former years. The records of our office show that not many years ago draftsmen, for example, were tested by such questions as "Name the tools a draftsman uses," "Define Plane Trigonometry," and similar queries. But there has been a development. Our method today is as follows: We give two days to the test. The first day is devoted to computations upon a chosen set of facts or data of an intensely practical kind. At the close of the day's work the applicant is required to place his results on a separate sheet. He is furnished with all the necessary hand books and tables and permitted to use slide rules for checking purposes. So far as possible no man in the engineering service, be he chainman, rodman, draftsman or engineer, should be given a test without access to all the usual equipment of his profession. If an examiner can't test a man without searching him and imprisoning him through the ordeal, he isn't equal to his job. The next day the applicant is required to bring his instruments. His tabulation of results is returned to him. We provide drawing tables, boards and papers and he is instructed to prepare a finished drawing from his results. Surely this will not be classed as a theoretical "examination." It is simply two days of the life of the ordinary draftsman taken as a standard for measuring his capabilities and this is not a bad conception of civil service tests today.

Age and Education. We hear much criticism leveled at the merit system to the effect that nobody but a college professor or a young man fresh from school can pass the tests that are given. The facts do not support the claim. We have taken a given year and tabulated the facts including all engineering tests from chainman to chief engineer. Of those passing, 28 per cent had a college education, 34 per cent had a high school education while 38 per cent had only common school training. At the same time, of those failing 20 per cent had college education, 23 per cent had high school training, and 57 per cent had only common school education. In fact, the man who made the highest average and was appointed to the highest engineering position for which I have ever supervised a test, had been denied even a high school training. In the test for district surveyor described above, the average age of those passing was 40

and of those failing 42. All of the four men who passed that test had a college training, while of the fourteen who failed nine had college education. A close study of these and other statistics will show that as a rule there are very seldom any unnatural results in this regard. Thus the merit system establishes its intense practicability in that it does not operate to the detriment of the mature and practical man and the undue advantage of the young and the theoretical.

The Merit System a Necessity. Three years ago the highway bureau of Philadelphia expending and supervising millions of dollars of public work annually had hardly a single actual engineer in its employ. Even the highway inspectors were very seldom men of even the slightest engineering experience or training. Civil engineering training and experience is now made an absolute requirement for this position by the civil service commission. Today the bureau has 20 engineers. It has also 160 engineering inspectors and highway inspectors, of whom about 140 are civil engineers by both education and experience, those lacking such training being hold-overs. And every one of them from the chief at \$6000 a year down the line is a product of the merit system of civil service. To thus transform a bureau requires that the department of public works take the initiative by creating a change in the type of service wanted, but the merit system has delivered the goods and thus played an important part in creating a field in Philadelphia for highway engineers, and, when necessary, we have gone outside the city to find the right men. Let me say that the question of residence should never be permitted to prevent a city from securing the highest degree of service. What you need is to build up a body of trained road builders in this country and you can't do it so long as local residence is a requirement for public service. I do not know of any way by which a technical service can so satisfactorily be created and maintained in public service other than through the merit system intelligently applied to each job to be filled.

New Developments. As a further proof of our own conviction that the merit system is practical, let me state that we publish every one of the questions after the examination is completed. This is done for a threefold reason: It is a scheme of education, it is convincing proof of fairness, and it compels the examiners to keep abreast of the great progress being made in the varied branches of engineering and on the alert for new questions and new tests. Perhaps the thing that would do more to convince this Congress of the adaptability of the merit system than all the addresses that we can deliver would be to read these questions in full. If there is any interested person who will write me, I will send him a copy of every question asked during 1912 or 1913. Not only that, but we keep every applicant's examination papers open for public inspection with the marks of the examiners thereon at any time after the results are published. The examining department has a library of the latest and best prac-

tical reference works on engineering that can be had and subscribes for and reads the best engineering periodicals. It does not purchase books of stale questions with cut and dried answers. The engineering examiners are university graduates with considerable practical experience. I mention these apparently unrelated items merely to show that modern civil service administrators are alive to their duties and are keeping up with the progress of the engineering profession.

The developments in the methods of the merit system in recent years have been nothing short of remarkable. Especially is this true when we consider the difficulties under which the system has labored and advanced. Let me suggest that the necessity of arguing here today the adaptability of the merit system to the engineering service does not arise from any errors in the principles upon which it is based, but rather from the way in which it has been handled from financial and administrative standpoints. Small wonder is it that its adaptability should be questioned when we recall that large cities pay higher salaries for court criers and writ servers than for engineering examiners who must prepare the tests and rate the qualifications of engineers for the public service. Fortunately, there are everywhere eminent engineers who recognize the value of the merit method of selection, and who, therefore, give their time and ability free of charge as special examiners. And when we add to this the frequent setbacks it has received under unsympathetic administrations, particularly in States and municipalities, we have an idea of its struggle for a permanent place in the plan of government. That it has survived and prospered under such conditions is the strongest proof of the correctness of the idea.

Creating a New Engineering Department. But the greatest test of the adaptability of the merit system does not come in the filling of individual positions, but comes rather when a department composed of only engineering positions is suddenly created by the legislative body and the responsibility for immediately filling those positions to satisfy an insistent public demand for action is put squarely up to the merit system. This has occurred recently in Philadelphia, and never did the merit system of civil service show itself to greater advantage.

The department of city transit was created a little more than a year ago by the act of the Legislature. It was created to supervise and control the construction and operation of great subways and connecting elevated lines to be municipally built and owned. A complete staff of about 140 engineers, draftsmen, transitmen, rodmen and chainmen had to be selected, and the character of their work was such that no existing eligible lists could be used. In other words, the merit system was called upon to produce a new engineering department for a new line of municipal activity at once. Examinations were immediately announced, the duties of the various positions stated, and the desired qualifications fixed. The number of

applicants was large, but first class engineers in private business willingly gave their services as examiners, and to make a long story short, there was never a time since the creation of that department when the civil service commission was not able to fill all requisitions for appointments. Although the director is allowed by law the selection of one name out of four, it is a testimonial to the effectiveness of the merit system that he chose his men almost invariably in the exact order of their standing on the eligible list. There were thus selected and appointed in that department within a short space of time sixteen engineers, whose annual salaries range from \$1,500 to \$6,000, and forty-two draftsmen, whose annual salaries range from \$1,000 to \$2,700 besides a number of checkers, rodmen, chainmen and tracers. As a matter of fact, this new department, created from top to bottom through the merit system, is perhaps, today the best equipped and best organized engineering bureau in the city of Philadelphia. We may spend many millions for subways and elevated lines but we have taken the precaution to lay the foundation for the supervision of that expenditure in the merit system.

The Appointing Officer's View. Perhaps it might be interesting to illustrate what the appointing officers think about the efficiency of the merit system of tests as indicated by their appointments from lists. Take, for example, highway inspectors. In a little more than the past year 114 eligibles have been certified to the bureau of highways as highway inspectors. Under the law the chief is not required to appoint more than four out of each seven. As a matter of fact, out of 114 names he has appointed 98, although the law would compel him to appoint only 56. And the first man has been appointed on every list but one. In appointing 35 draftsmen the chief of the Bureau of Surveys has passed over only nine names, when he could have passed over several times that number without violating the law. In a little more than a year nine eligible lists have been created for highway engineers at various salaries from \$1,500 to \$4,000 a year. In eight of the nine cases the Bureau of Highways has appointed the first man on the list. Not only that, but in one case, for example, they have appointed eight out of the first nine on a list. These bureau chiefs were thus by no means taking advantage of that provisions of the law which enables them to pass over three names out of every seven, and it must be borne in mind that they are not making their appointments practically straight down the lists in order to glorify the civil service system. It is only natural and proper to presume that their purpose is to render successful administrations of their bureaus by getting work done and getting it done right. It is most convincing proof that the merit system properly discriminates between the competent and the incompetent in the engineering service.

You will note that in this short paper I have necessarily limited myself to a discussion of original entrance to the service and have omitted other important matters, such as protection in tenure,

promotion and other things. The merit system has come to stay and its the rock upon which any stable and efficient engineering service must be built and maintained.

THE CHAIRMAN: The subject is now open for general discussion.

MR. PATTERSON (of the Prison Commission of Georgia): We have had under consideration for some time in our department the selection of road engineers to assist the various counties in Georgia in their road work. I was extremely interested in hearing this discussion, because we have been somewhat at a loss to know, when we employed those men how and where to get them. The law provides that these men employ not more than four supervisors who shall visit the various counties, inspect the convicts in their work and perform such other duties as may be required of them by the commission; also that it shall be the duty of the supervisors to inform themselves thoroughly upon the subject of road building, etc., and in the economical handling of convicts. It provides that the salary of those men shall not exceed \$1800 per year and expenses. Now how can we get—what kind of method could we employ to get these experts, who shall be civil engineers, if possible, but who shall be experts in this line of work—to give this assistance to our various counties in Georgia? The weakness of the system in Georgia is the fact that the State does not provide this expert assistance. Our counties are working their roads by convicts and some of them do not feel financially able to secure expert engineers to put in charge of this work, but the law provides that the Prison Commission shall employ four experts who shall visit the various counties, spend as much time in them as possible and instruct the men in handling their convicts, building their bridges and doing the engineering construction for these various counties. What kind of method can we employ to get competent men?

MR. SWANSON: Who has the appointing power?

MR. PATTERSON: The Prison Commission. I am a member of the Prison Commission.

MR. SWANSON: And the work is temporary?

MR. PATTERSON: No, it is permanent and the salary is \$1800, and expenses; it is equivalent to a salary of \$3000, if a man pays his own expenses.

MR. SWANSON: I understand they are employed both winter and summer?

MR. PATTERSON: Yes, the year round.

MR. SWANSON: Well, I think if you could do it, the first thing to do would be to set aside any idea of residence within any particular county or even within the State. Would these men be confined to a single county?

MR. PATTERSON: No. There are just four of them and we have 120 counties working convicts; each man would have charge of the supervision of the work of 30 counties.

MR. SWANSON: It seems to me if your Prison Commission would appoint a board of high class engineers within the State, say three men whose fairness of mind you could count upon and whose interest in the work was real and genuine, and then proceed very much the way we do with the civil service examination, that is, issue a notice which might be put in various papers within the State, and if you decide to set aside residence, put the notice in such papers as the *Engineering News*, *Engineering Record* and *Manufacturers Record*, outside the State—a short notice describing the kind of position you are going to fill, the salary and the method by which it will be filled and giving such assurances as you can as to the tenure of office, and then specify when and where the men should send their applications. That will be a preliminary step. Now, if you have not had much experience with examining people, it seems to me that an examination consisting of a consideration of their training and experience, together with an oral interview before such a board as I mention, would be the proper way to do it, because in those supervisory positions where men have charge of other men as these men would have, I want to say to you that it is very largely a question of what a man has done and what his personality consists of. I want to urge upon you the importance of the personality of a man in a position where he has supervision, and the only way to get that is by an oral examination before some perfectly fair and honest board that you might designate. I should say that all applicants might be requested to send in statements of their training and experience. These could be gone over by this board and such of them as seem to be worth while could be sent for to be interviewed by the board on a certain day and then the board could grade and rank them on a list that you can appoint from. If you have no civil service law, then in your original announcement you ought to specify a method of selection and that you are going to take them exactly as they stand on the list or are going to take one out of three so that a candidate would have some assurance as to how he would be treated if he came as a competitor.

MR. PATTERSON: The University of Georgia and the Georgia School of Technology both have departments of engineering; would the heads of those departments make good examiners?

MR. SWANSON: Yes, sir. I would try to draw into the work, besides those men, men who are out in the world on actual construction; I would not make a board altogether composed of college men.

MR. PATTERSON: I see. That is just the information I wanted.

MR. A. R. JOHNSON (of Tennessee): I desire to ask this question; I gather from the statement in regard to the painters of Philadelphia, that they selected those men who showed the most efficiency at the time the work was done. Now suppose we take the average proposition up in my county of building roads for the first time. We want engineers, of course, and we want contractors. I think you have answered the engineering part of it fully, but what, if any, examination should the contractor stand and what efficiency should he show before he is employed and the work turned over to him.

MR. SWANSON: Well, that is entirely a new problem. I have never had any experience with it, but I should say it seems to me that you could get that from the reputation of the contractor in his community, through first class business references which he might be able to give and through an examination into the jobs that he has had and the way in which he has done them. I think it is more a question of the standing of the contractor in his own community in that case. I understand that you mean the man to whom you are going to let your contracts and who is going to do your work?

MR. WALES: Do you want to know if you are going to select that contractor from a number of people, how you would hold him responsible?

MR. JOHNSON: We have tried to hold him responsible by contract and have failed. I am so much delighted with the talk this evening on the merit system that I thought I might take some little of it and apply it in getting contractors to do the work that we propose to do over in Tennessee. I want a man to do it that is capable and will go along and do it. Now as to his capability, I wanted to get some idea as to how I would know. That is what I want to carry home with me.

MR. WALES: There would be no competitive selection, of course.

THE CHAIRMAN: I suppose you would have him give bond for the good performance of his work and would have competition. Would not your engineer draw up some system of competition for the work that these various contractors would bid upon?

MR. JOHNSON: Yes, that is true, but from your statement I gathered that there's thousands of dollars wasted on these contracts and I want to avoid that trouble.

THE CHAIRMAN: Then have a good engineer appointed who will inspect the work properly before payment is made.

MR. LEECH (of Ohio): It seems to me that the worst stumbling block in the way of the merit system is the question of local residence. It is very little trouble for a city the size of Philadelphia to find within its boundaries sufficient well trained engineers to fill the vacancies, but in some parts of our country, or some of our smaller villages, there is not within them possibly a well trained engineer. The legislatures, in forming a great many of our laws, provide that the villages or the mayor shall appoint a civil service commission and they in turn hold a competitive examination, and quite frequently, within that very village there is not more than one or two, at most, that are qualified to compete. The result is that we get the same men who have been doing the work right along. There is really no competition, and no increased efficiency. It seems to me that it would be well if we could get away from this local residence phase and open up the examination to the capable men, let them come from Maine or California or from one extreme of the country to another.

THE CHAIRMAN: That is the course we advised and in arguing the question before some authorities who wished to limit the examination to residents, we made this argument, that if we bring in a man from another State and he is employed all the year, you have another resident that comes in and occupies new property, spends his money in your State and adds to its wealth, as every good, competent man does. In Massachusetts it is left to the civil service commission. They have full freedom to go outside, and in the higher positions like that of engineers, they frequently go outside the city and even outside the State. I understand that the same is true of Philadelphia.

MR. WHITNEY (of California): I am interested in this question of going outside your own county or outside your own State to select a competent engineer. In Sonoma County, Cal., about a year ago, there was a highway commission appointed for the purpose of looking into road conditions and to finally map out a road system for that county. I happened to be one of that commission, and after I assumed office, the question with myself and the other commissioners was, where to find a competent man to do the work. We had engineers in our county, or surveyors who thought they could do the work as we desired, but we were not satisfied that they were the men; consequently we commenced to look around.

We could not resort to your civil service examination; we had no means by which we could do it, so we investigated the standing of different engineers in the State of California. Finally we went to San Joaquin County, where we found a young man who had been sent out to California several years ago by the Department at Washington. He was sent out to make a report on soil conditions of San Joaquin County. He made a report and about this time the county had concluded that they wanted a better road commission. They had formed their Good Roads Club and commenced their campaign and finally it reached the point where they appointed an expert engineer to do that preliminary work for them. They selected this young man who was sent out from Washington and he made the preliminary surveys, gave them their estimate and finally was employed and received a discharge from Washington. He was employed to go ahead and construct the roads in San Joaquin County. They had bonded for nearly \$2,000,000. He came there and had charge of the work during its entire construction and we investigated the result of his work both by examining his road and by all the information that we could gain from every source possible, and after a thorough examination and investigation we concluded that he was the man we wanted and employed him. There was a condition in which we went from one county to another in the State, and selected a man for his fitness, and I think we were fully justified by the results accomplished.

MR. KING (of Memphis, Tenn.): This is a matter, gentlemen, that is going to adjust itself in the course of time. In the South this matter of the employment of engineers who superintend road construction is new and most of our road builders have thought that the position was a sinecure, an easy job; but we are getting away from that, and because they did think it was an easy job, they expected some taxpayer in the county or some son of a taxpayer to receive that job; but with us in Memphis, Shelby County, we are adopting not only the merit system but we are insisting that a man must give value received to the county for his salary, in labor and in skill. Now there is not a business man, commercial or agricultural, who adopt that plan of employing men who live only in the city in which he lives. So this old method and system of employing men to hold official positions merely because they happen to live there and are taxpayers—we are going to get out of that and our young men are going to prepare themselves for it; and I see, my friends, no very great trouble because we are now coming to the point where we are building roads scientifically, and we are employing skilled men who are going to give all their time to the work.

THE CHAIRMAN: There were two more papers scheduled for this afternoon and I am afraid we will have to close the debate if the

gentlemen who are to read those papers are here. The first paper is "Engineering Supervision of Road Construction" by W. S. Keller, State Highway Engineer of Alabama.

ENGINEERING SUPERVISION OF ROAD CONSTRUCTION

BY W. S. KELLER,
State Highway Engineer of Alabama.

This question confronts every commission that has the building of good roads, and it would appear to the business man that the wisdom of having an engineer supervise the expenditure of large sums of money on highway construction, would not be questioned any more than a railroad company would question the wisdom of employing an engineer to locate and supervise the construction of a railroad.

We may, therefore, for discussion divide this subject under two general heads:

Is engineering supervision of road construction necessary?

Why is an engineer better fitted to supervise road construction than a practical road builder who is not an engineer?

The average county commissioner has had no experience whatever with an engineer. He has, however, carried the rear end of a chain for the county surveyor, and, in unison with his colleague, the front chainman, cried "stick, stuck." He has a very exalted opinion of this man with the Jacob staff and compass who is able to follow land lines for a distance of three or four miles a day. Far be it from me to belittle the county surveyor. I would, instead, erect a monument to him as a martyr who receives a pittance for his labor and a "cussing" for his pains. We point with pride to the fact that the "Father of his Country" was a land surveyor, but we seriously doubt if he was competent to locate, and properly supervise the construction of roads.

Engineering supervision of road construction is absolutely necessary and this statement is proven every day, positively and negatively, in this state of Georgia. A layman riding over the roads of Georgia can tell at a glance a road that has been located and built under the direction of an engineer. When he rides over a road that has been constructed along the old trail, located by the Indians and early settlers, without any regard whatever for grades and very little for drainage; he sees the hand marks of the commissioner, who saves his county the salary of an engineer, and spends it thrice over in useless work and expensive maintenance.

Despite the fact that a majority of commissioners or supervisors have had no training whatever in road building, they will concede to no one that they are not as well qualified to direct road work as any engineer they can employ. They will often admit that an engineer should locate and stake off a road, but they think his duty ends there. It is just as necessary that an engineer supervise construction work as it is that he should locate the road. How many commis-

sioners in the hearing of my voice can tell me how much it costs to move a yard of earth or how much it costs to install pipe of various makes—how much per cubic yard their concrete culverts are costing them? You may say we know how much per mile our roads are costing, why should we bother to know the unit cost? Why, my friends, does a merchant keep the unit cost of his wares? Because he desires to buy from the man who sells the cheapest. So, a county should know if its roads are costing more than they should.

The commissioners of a certain county in Alabama claimed that they were building roads as cheap or cheaper than any contractor could do the work. They had an engineer estimate the cubic yardage of earth moved for a certain period of time and to their surprise it was costing $37\frac{1}{2}$ cents per cubic yard when the average contract price in Alabama for three years had been 23 cents per cubic yard. Authorities should know whether they are getting value received for their money, and an official who overlooks such a vital question, is not true to the trust placed in him by the people.

Many counties are imposed on in the purchase of material and supplies and are actually paying more for such in large quantities than individuals have to pay for the same in small amounts. This is usually attributed to either carelessness, politics, or a false idea some of the commissioners have as to their duty. I believe the duty of commissioners, in so far as road building is concerned (and it can equally as well be applied to other public matters) is to purchase with as much care and secure just as low prices as they would if buying for themselves as individuals, regardless of whether the goods purchased come from local or foreign merchants; of course, giving always the preference to local merchants, if their wares are as good and prices as low as those of outsiders. It is not the duty of road authorities to conduct county affairs so as to make money for individuals or to give jobs to political henchmen. If a competent man cannot be found within the borders of a county fit by experience for a position such as foreman, it is right and proper that a competent man should be secured from elsewhere.

The remedy for these ills is, unquestionably, to have some one in charge of road building qualified by education and training and free from political influences, who can be held responsible for results. Very few counties have commissioners or supervisors who devote all of their time and attention to their office, and it is self-evident that an engineer trained in road building will get better results than can any set of men who give only a few days in the year to their public office.

As to the second division of this subject, "Why an engineer is better fitted to supervise the construction of roads than a practical road builder who is not an engineer." First, an engineer is indispensable, even though you have a splendid layman to supervise the work. A large percentage of all roads to be constructed require relocation, profiles made, grades established and if the work is to be contracted,

the road must be cross-sectioned and the yardage of excavation and embankment calculated and made to balance as near as possible. Such work, a layman cannot do. Who is better fitted to supervise the construction of any job than the man who plans and specifies the work? The road supervisor is usually uneducated and it is practically impossible for him to correctly account for the expenditure of large sums of money and equally as impossible for him to keep cost account of his work.

This condition is usually brought about by a disposition on the part of the Board of Supervisors or Commissioners to economize. Unfortunately, many county commissioners can see only the engineer's salary to be paid twelve times a year and the inevitable result that there will be quite a decrease in the number of days they can legitimately demand pay for laying off and superintending the building or repair of roads in their respective districts. In other words, the engineer is a usurper, taking away the salary of those guardians of the people's right who are so anxious to save money for the people that they save \$200 per month engineer's salary and spend \$500 per month in doing it. So long as we elect officials because of their popularity rather than fitness, and pay them a mere pittance for their services, we may expect many of them to be incompetent and often dishonest. A striking case, and which I am sorry to say is typical in many sections of our country, came to my attention in Alabama. A foreman in the employ of a certain county was discharged by the commissioners of the district in which he had been working. The commissioner gave as a reason for discharge, that he himself could look after the teams and hands and thereby save the county several dollars a month. The foreman resented his being discharged and took upon himself the investigation of the commissioner's record. He found that on a certain day this commissioner drove seven miles to a small bridge where he then and there made a contract with a party to repair the bridge at a cost of \$1.50. A few days later he went back to this bridge to inspect the work he had ordered done. The record of the Commissioners' Court showed that cost of repairing was \$1.50 and cost of inspection two days at \$3 to \$6. Did this commissioner do a dishonest act? He certainly was entitled to pay for at least the time consumed by himself yet it is manifestly wrong for such a condition to exist that cost of supervision is four times that of construction or repair. This would have been a very small matter to an engineer who, while having the bridge repaired, would attend to many other duties.

It is almost impossible to convince many county officials that an engineer can easily save his salary several times over by making certain changes in location and grade and by economically administering the affairs of the county. As a general rule a county gets more in return for money spent for engineering services than for any other single item connected with road construction. A good engineer is a dividend producer for a county. In speaking along this line at the

American Road Congress held in Atlantic City in 1912, Col. W. D. Sohler said:

You will find if you look at any private corporation, that the ordinary engineering expenses for any work of the character of road building, any constructional work, is usually about 10 per cent, and that it is good money well spent.

Someone has said that an engineer is a man who can do as much with one dollar as a fool can with two. Evidently he did not have reference to the fool engineer.

The most expensive fool is the fool engineer. He is to a very great extent responsible for the prejudice many have against engineering supervision of road construction. There is absolutely no excuse for a county employing an incompetent man, now that the government, through the office of public roads, stands ready and anxious to aid any county in securing a good engineer. An engineer applying for a position should be endorsed by those for whom he has worked and by men competent to pass judgment on engineering work. It is an easy matter for a man to get endorsements from friends who have perhaps known him in a social way, but such are only beneficial to prove his good character. An engineer with only a good character will build a road without any "character."

A highway engineer should have a good technical education and to be successful, he must be practical and he must be a diplomat. He should be sober, honest, energetic and think more about the work he is trying to do than the pay check he will receive at the end of the month. When taking charge of a county's road affairs he should convince the commissioners that he knows more than they do about building roads and then proceed to prove it by doing good work. Unless an engineer can absolutely convince his Board of Commissioners that he knows his business, he had best resign. Trouble is often brought about by the engineer failing to have a thorough understanding as to his duties. This can easily be avoided if, when an engineer makes a contract with a county, he clearly sets forth in this contract what his duties are. If he is to be held responsible, and he should be, for the success of the undertaking, he should have full power to employ and discharge those under him. I think this is well expressed in Rule 2 of Rules and Regulations of the State Highway Department of Alabama, which reads as follows:

The functions of the Commission are judicial and those of the engineer, executive. The engineer will receive and carry out the directions of the Commission and shall, in turn, direct those under him. The engineer shall have full charge of construction work, directing it in all its details. Any orders the Commission wish to give an employe shall be given through the engineer, and the engineer shall have the right to employ, with the consent of the Commission, and to suspend, subject to discharge, without consulting the Commission. All suspensions shall be reported to the Commission for such action as they deem necessary.

In conclusion, let me say to you who are commissioned to spend the people's money, if you are in doubt as to the advisability of

employing an engineer, observe closely the roads of a county built without the guiding hand of an engineer and then those of another that have been built by a man skilled in highway engineering. Don't employ a man whose only qualification is that he is cheap. His salary will be small and his mistakes will be many and expensive.

When you are sick you call the doctor,
When you are mad you call the lawyer,
When you are hungry you call the baker,
When you are broke you call the banker,
When you are in trouble you call the preacher,
When you are ignorant you call the teacher,
When you want cotton you call the farmer,

Then, when you are in need of good roads, why don't you call the engineer, that good roads physician who will heal the wounds of the country roads, who will operate upon their surfaces and place them in perfect order.

In conclusion, permit me to say, I have no ill-will or animosity for any road official. I have tried to point out some of their false ideas and mistakes and offered, as best I could, a remedy.

MR. JACKSON: After hearing the address of Mr. Keller, of Alabama I wish to make a few remarks. I happen to be a county commissioner and naturally paid some attention to the remarks of my friend from Alabama. I fully agree with Mr. Keller on one point and that is the necessity of engineers supervising the work in the various counties. I think that I can prove my statement by the past record of the county commissioners in the county which I have the honor to represent, Hillsborough in South Florida, because when we voted a bond issue of a million dollars, more than a year ago, we sought a competent engineer at a salary of \$5,000 a year; that in itself is proof that I agree with Mr. Keller on the necessity for engineers. In addition we have an engineer employed for our regular county work and have had for some years past, at from \$1200 to \$1800 a year, and I don't want this Congress to think that all the county commissioners of these Southern States are prejudiced against engineers.

THE CHAIRMAN: Mr. Robert C. Terrell, State Highway Commissioner of Kentucky, will open the discussion on Mr. Keller's paper.

MR. TERRELL: In discussing Mr. Keller's paper on "Engineering Supervision of Road Construction," I have no criticism to make, and wish to commend the statements that he has made.

In general, however, I wish to call attention to, and emphasize the fact, that not only in the State of Georgia, but in every other Southern State "the marks of the commissioner (or member of the fiscal court) who saves his county the salary of an engineer and spends it thrice over in useless work and expensive maintenance" this

is true; and where the services of an engineer have been omitted, the roads in general follow the old pack-horse trails, which in turn followed the foot-paths of the Indian who climbed from the top of one high hill to the top of the next on the shortest and most direct route and in order to attain the highest point from which to search the surrounding country for the herds of buffalo, deer and elk and in order to be on the lookout for the enemy.

Roads constructed along these lines are unnecessarily steep, hard to construct, and ten times over, harder to maintain, than those which are laid out by the engineer. In the State of Kentucky there are splendid examples of the difference between roads thus built and those built by engineer; for as early as 1830 the State began the construction of roads under the supervision of competent engineers, the director of this engineering force being a Frenchman who was thoroughly familiar with the methods of location and construction used in France at that time. Roads laid out under the engineers during that period still show marked evidences of the skill of the engineer in the easy grades, easy curves, good drainage, wide roadbeds and types of construction. In the many miles of road which were constructed during that period at which interval improvement had its being and reached its zenith in the Southern States are monuments to the progressive and intelligent ideas that were then prevalent among our political and economic leaders.

These roads in many instances were cut from solid rock in order to secure proper grades and alignment, and massive stone walls were built where necessary, but with the backward swing of the pendulum followed by the calamities of the Civil War, the wheels of progress stood still, not only in commercial and financial lines but also in road building and engineering supervision as well. Since that time, however, little progress has been made, although many miles of roads have been surfaced with stone or gravel, at possibly much lower first cost than were the roads previously mentioned; yet the maintenance (or possibly better put, the necessity for completely resurfacing the roads) has made them much more costly; yea, thrice over more costly than the original cost, and the maintenance of roads built under engineering supervision many years before.

The Southern States have probably suffered most from the lack of engineering supervision on road construction due to the reason given above. After the close of the Civil War, the commissioners (or magistrates) felt it their duty to save the salary of an engineer and to surface as cheaply as possible the largest number of miles of road, believing that a road surfaced with stone or gravel would last indefinitely; paying no heed to grades or drainage and basing their calculations upon the results of roads built by engineers in an earlier day who had given special attention to the points entirely overlooked by the commissioner or magistrate. Little did he dream that his penny-wise policy was costing his county pounds; yea, many thousands of pounds annually.

No pendulum ever swings so far, however, but that it must swing back again; and in 1912 the State of Kentucky saw the dawn of a new era in road building when the State again provided for engineering advice on the construction and reconstruction of the public roads and bridges; and still more definite steps were taken by the 1914 General Assembly in the passage of additional laws designating a system of State highways and providing for State aid for their construction and engineering supervision on all work to which State Aid was granted. Already the fiscal court, or board of magistrates, of the various counties are seeking to take advantage of the State aid engineering advice and supervision, and are beginning to realize more fully every day the advantages of building with a view of not only caring for the present, but looking to the future development of the country and the travel that the road will be expected to carry by constructing or reconstructing their roads in such a manner as to care for the traffic of the future as well as the present.

Mr. Keller's paper has brought out well the advantages to be gained by having engineers take up the estimates, look after the purchase of materials and see that the unit costs are kept, and that the prices paid are correspondingly low. The material salesman has found that for the official who is not skilled in the purchasing of such material is prone to reject the advice and information furnished by engineers, or rather resent the idea of consulting an engineer; that to this type of man he needs only to pat him on the back, flatter him on his judgment and business ability and secure the contract at an advanced price, and in many instances, at a sufficient price to enable him to induce his competitors by one means or another not to interfere.

To this type of official, the material dealer finds the flattering tongue for the commissioner (or magistrate) and a denouncing tongue for the engineer very profitable and effective, as the engineer as a rule refuses to stoop to heated arguments or personalities with the dealer. However, this tendency toward the electing of more competent officials who are more conscientious, intelligent and business-like, is the rule rather than the exception, and with the upward trend comes the recognition of the engineer and his value in the supervision and road construction.

I have endeavored to point out only a few advantages of engineering supervision which are apparent in my native State, and in closing I wish to say that I do not feel that I can add very much to Mr. Keller's splendid paper. I wish to heartily endorse in general the statements he has made.

THE CHAIRMAN: The next paper is "State Control of Road Work as a Policy," by Mr. A. N. Johnson, of the Bureau of Municipal Research, New York City.

STATE CONTROL OF ROAD CONSTRUCTION

BY A. N. JOHNSON

Bureau of Municipal Research, New York

The control by the State of road construction has grown from zero in 1893 to a widespread policy among the States, varying much in degree and method of application; from extensive control extending even to supervision over the smaller political units, to concern only with a few highways in whose construction the State is directly financially interested. Between such wide limits there exist almost all degrees of State interest.

Before entering upon any discussion as to the merits of the policy of State control of highway construction, it is perhaps well to make a brief summary of existing conditions. For this purpose a study has been made of the road laws, advantage being taken of summarized statements where they existed or were at hand for consultation. It may, therefore, happen that in some details of the table herewith presented there may be some slight error, due to the interpretation from the road law itself to the summary, and also the interpretation placed upon the summary. However, as the purpose of this table is merely to give a general view of conditions which would not, therefore, be seriously modified by any slight error, it was not thought of sufficient importance to take the large amount of time that would have been necessary to check carefully this table against the text of the road laws themselves. In the main it is believed to be accurate and for the purpose devised, trustworthy. Some analysis and explanation of the table will aid in its interpretation.

The States have first been checked in regard to the existence of a State highway department. Checks have been made in divisions under this general heading showing whether a State has highway commissioners and a State engineer, or both. Under the heading "commissioners" the States have been checked to show whether the commissioners are appointed or elected, whether any qualification is required, whether any members of the commission are ex officio members. Under the State engineer it is noted whether he is an appointive or an elective officer and whether any qualification is required.

The next main division is State aid roads. By State-aid roads is meant specific sections of roads for which the State pays some portion of the cost, and exercises direct supervision in their construction, as contrasted to a few instances where the State pays the towns certain money to assist in the construction of their roads in general. Under State-aid roads it is noted whether the construction is controlled by the State, and whether maintained by the State or by local authorities. Also, whether they are paid for entirely by the State, by the State and county, by the State, county and town, and whether the land owners of abutting property pay any portion of the cost. The

STATE CONTROL OF ROADS																						
STATE	STATE HIGHWAY DEPT COMMISSIONERS STATE ENGINEER						STATE AID ROADS						OTHER ROADS									
	APPOINTED	ELECTED	QUALIFIED	REQUIRE	EX OFFICIO	MEMBERS	APPOINTED	ELECTED	ANY	CONTROLLED	BY STATE	MAINTAINED BY STATE	BY LOCAL AUTHORITY	STATE	STATE	STATE	STATE	STATE	STATE	LOCAL ONLY	LOCAL ONLY	LOCAL ONLY
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REMARKS

State prepared by experts

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relation of the State to other than State-aid roads is shown by the control exercised by the State, whether advisory or specific, that is, the State exercising by law definite supervision or whether the roads are entirely under local officials' control. The existence of local highway engineers is also noted, whether they are appointed by the local authorities or by the State department, and whether there is any qualification required on the part of the State; again whether their actions are controlled in any way by the State or are under the control of local officials only.

The source of money expended upon the roads is noted, whether from county or township taxes, whether, where townships exist, there is any provision for county aid to the townships; also whether local communities receive any aid from the State to assist in the maintenance and construction of their local roads in general.

Some of the facts to be noted from this table are: that there are but seven States without State highway departments. There have thus been created in the past twenty years thirty-six State highway departments. Of these thirty-six States it is to be noted that thirty-four have State-aid roads, that is, specific pieces of road which are constructed in part by State funds; five of the State highway departments have no commissioners, only a State engineer; while fifteen have State commissioners and no State engineer. It is thus seen that a majority of State highway departments are organized with a commission and State engineer.

The State highway commissions are appointed in part or in whole in thirty-one States, while in fourteen the State highway commissions include ex officio members. In but one State is the highway commissioner elected, and in seven only are any qualifications required. In twenty-seven the State engineer is an appointive officer. In no State is he an elective officer, but in six only are qualifications required. Where any qualifications are required for the position of State engineer they are for the most part among the recently enacted State highway laws. State highway legislation could be much bettered, if qualifications were required in all the States where State engineers exist but it is at least some satisfaction that the State highway engineer is in no State an elective officer.

In the States where State-aid roads are built, it is to be noted that the construction is controlled by the State in thirty-four instances. In twenty-one instances the State-aid roads are maintained by the State, that is, the State exercises immediate supervision and control of the maintenance, although the expense of the maintenance may not be in each instance fully at the cost of the State. In the remaining instances the control of the maintenance is in the hands of local officials. As it was a number of years before any State save Massachusetts exercised control over the maintenance of the State-aid roads, the large proportion that now do take charge of this important function shows a greater realization of the importance of maintenance of the State-aid roads by a central control, and where States

are contributing funds towards any considerable mileage, they must soon realize the absolute necessity of State control of the maintenance of these roads if the service that State-aid roads should render the public is to be secured and the investment made by the State in their construction conserved.

The method of paying for State-aid roads varies in different States, and it varies for different roads in the same State. Some States, for example, have a certain system of highways for which the State pays all the cost, while on another system of roads the State and county divide the cost. There are fifteen States in which the State pays the total cost on State-aid roads, although some of these States also share with the county or town in the construction of other State-aid roads. There are twenty-six States in which State-aid roads are built by the aid of the State and county, two in which the State and town are contributors; also but two in which any assessment of the cost of the State-aid road is borne by the adjoining property. It is thus seen that most States consider that State-aid roads should not be paid for by assessments on adjoining property.

The control by the State over other than State-aid roads has been a recent development and its origin may probably be traced directly to those States which began their State road work by the organization of a commission to study and report on conditions before undertaking definite expenditures for State-aid roads. This was first undertaken in Maryland, and the law provided that the State could advise with local authorities as to the construction of their roads and bridges, and the work of the Maryland highway department demonstrated that there was much to be gained by advisory supervision on the part of the State. Such work has been done by a number of States only to a greater degree, notably, in Illinois, Wisconsin and Iowa. The work in these States at first was advisory only, that is, the local authorities coöperated with the State departments voluntarily, the law not requiring that they should necessarily follow the advice given by the State. But the remarkable success of this work, the widespread influence it exerted after a few years of activity, the hearty coöperation on the part of many local officials, and compulsory coöperation through public opinion on the part of others, demonstrated conclusively the wisdom and the need for definite control by a State highway department over the activities of local road officials.

Today advisory control is exercised by State departments in twenty-three States and definite control already exists in three.

Perhaps the greatest significance attaches to the fact that there are fifteen States in which local highway engineers are provided for by statutes. This is in considerable contrast to the opinion that road work could be done by anybody and did not require any skilled supervision. But the fact that in no more than a third of the States are local engineers required by statute shows that the appreciation of skilled control has not spread to the extent that it should. The work that has been accomplished by the highway engineers in the

past ten years in this country has demonstrated beyond further argument the need for such control.

The reason for a policy of State control of road work that exists in so many States, and is increasing, will be found in the demand of the people generally in all parts of the country for better highway service. Highway transportation has become an increasing factor in economic development, and with its increasing importance there is demanded better transportation facilities of the highways. This necessitated that the highways should be given better attention and different treatment than had been the practice. The problem of highway development is realized to be of general concern, not merely local. The interests of one locality in this problem is no longer confined to the roads immediately adjoining, with the result that it has been manifest that a larger unit of control than a town or county would be necessary if the development of the highways was to be such as would make it possible for them to render the service the public demands. There has, therefore, grown, as we have seen, an increasing control by the State over the local communities in the matter of road building, and as a broad policy, resting as it does on sound economic conditions, it is not only wise, but inevitable; and that it is practical has already been demonstrated by the work done in many States. Among these may be mentioned notably Massachusetts, Connecticut, New York, Illinois, Wisconsin and Iowa.

Perhaps the most interesting study of State control is to be had from an examination of the Iowa law and its practical application. In Iowa the State highway department spends no money on State-aid roads but it is concerned solely with the direction and supervision of the taxes raised by the local communities for expenditure upon their highways.¹

The work done in many States, particularly in Illinois, has demonstrated the efficiency of road construction by day labor. As carried on in Illinois, the State furnished the skilled supervision and the more expensive machinery, the locality, the labor and teams. There is a two-fold benefit gained by handling the work in this manner—the quality of the work is superior to contract work, or perhaps, a fairer statement would be, the quality of the work desired is more readily obtained, and is done at a cost to the community less than it could be done by contract. Where State control of road work exists and extends into the concerns of the smaller units, it is possible for a much greater variety and amount of work to be handled by day labor, than would be at all wise or practicable if the skilled supervision that the State highway department can furnish the localities could not be obtained.

What has been realized from State control of road work may be

¹For more detailed examples and accomplishment through the policy of State control of road work, the reader is referred to the paper prepared by Mr. Thomas H. McDonald, State Highway Engineer of Iowa, to whom is due chief credit for the splendid results that have been attained in that State.

thus summed up: The development of a system of main highways adapted to modern motor freight traffic which promises such great economic changes in both rural and urban life, increasing the efficiency of local road officials in the expenditure of the local taxes by preventing useless undertakings, by suggesting economic forms of construction and by increasing the economic service of the highways by concentrating expenditures on important roads and preventing waste on unimportant ones; the prevention of numerous accidents and fatalities by the construction of safe bridges and elimination or treatment of railroad grade crossings in such a manner as greatly to lessen the danger from them. And experience has demonstrated that these ends are accomplished by State control of road work and only by such control.

THE CHAIRMAN: Next on the program is the discussion of Mr. Johnson's paper, by T. H. MacDonald, State Highway Engineer of Iowa, which will be read by Mr. H. C. Beard, member of the Iowa Highway Commission.

MR. BEARD: *Mr. Chairman and Gentlemen of the Congress:* This paper was prepared by Mr. MacDonald, our highway engineer, who is unable to attend this meeting and I will read it. I will also say, while I do so, that at one place in this paper, I wish to enlarge a little bit upon it relative to the organization that we have completed under the law as laid out here. State control with State aid, as pointed out by Mr. Johnson, is written into all of the older State laws which established and placed in authority, State Highway Departments. State control without State aid is a new principle in such legislation because of the long association of these two ideas, they have become confused in the popular mind so that State control has come to mean State aid, and if a State proposes to exercise certain control without paying for the privilege by the appropriations of funds to the local communities the State immediately encounters more or less hostility from these communities. The more or less is dependent upon the number of local patriots who are willing to sacrifice their own personal interests on the altar of public service, i.e., in some office within the gift of the voters. Seriously, however, the principle of State control is quite separate and distinct from that of State aid appropriations, and these are not necessarily complementary State policies. State aid may be appropriated from State revenues received from sources which do not contribute to local taxes or it may consist in a distribution of State tax receipts on property which also pays local taxes. If the former, then State control with State aid is a justifiable policy only if this control secures equal or greater returns to the State than if such aid were distributed without State control. If the State aid funds are simply the distribution of direct property taxes, then State control must justify itself by better results than if the same amount were ex-

pended as local taxes. As shown in the preceding paper all of the thirty-four States which have State aid roads, exercise State control over the construction and twenty-one States have found it necessary to take over the control of the maintenance. It seems to be a thoroughly established fact that the State must control the maintenance of State built roads if these are to be maintained adequately and continuously. This fact is proof positive that State aid is something more than the appropriation of money, and that it contributes an element of administrative efficiency that is not in any way measured by the amount of funds appropriated. If this be true, then in this fact we find a justification of State control without State aid. From a study of the policies of the method of extending State aid as set forth, each method is a product of the method of raising State revenues, the state of development of road construction reached, the area or mileage which the plan is adopted to cover and the particular type of administrative scheme adopted. The older State laws in force in the Eastern States show the influence of the French and other foreign administrative plans. These methods as they have been adopted by States further west, have been changed or modified by the above factors. The more recently adopted measures in the upper Mississippi Valley States have shown a considerable divergence from the older plans. As stated by Mr. Johnson, these plans were adopted generally after some years of operation of a commission or State Highway Department having advisory powers. The work of these departments greatly demonstrated the desirability of a more efficient use of the funds available and the possibility of greater results with such an administration than through increased appropriations without an efficient administrative system. Of the highway laws that have been passed in recent years, the Iowa law probably contains more distinctive departures from what might be termed established practice than any other law. The less than two years in which this law has been in operation is far too short a time to judge of the measure as a practical working policy. That it is not yet a finished or polished administrative measure will be admitted by any of its warmest friends, but even its enemies must admit that the change in the road situation in the State, speaking from the balance sheets which show the results accomplished, are surprising. Those competent to judge expected that it would take five years to bring such a measure into a satisfactorily working system, but in many of the counties practically the first year's work has shown the law enforced almost to the letter so far as the county work is concerned, and in these a considerable portion of the townships are operating in full accord with its provisions. The smoothness with which the system has been working in many of the counties has astonished those who expected several years of general opposition to a policy of State control without State aid. In formulating this law, which is taken as a typical example of a law formed to supply State control without State aid, the General

Assembly of Iowa disregarded practically all measures relating to roads and bridges then on the statute books, excepting those relating to revenues alone. An entirely new road measure was drafted without changing the revenues that could be raised for road and bridge purposes. One fund was made a mandatory levy in place of an optional one, which is absolutely the only change in revenues made. It is true that a somewhat larger sum has been raised for road and bridge purposes the past year than during previous years, but this has been due principally to increased valuations, and the per cent of increase is not large. We have then the situation of a measure providing State control over local administrative units under an entirely new system without a material change in the revenues. If under such a system results greater than under the old system are secured the policy of State control must be given the major share of the credit, as it will not be due to increased local revenues, and there is no State aid fund. Briefly the plan of organization is as follows: each township is controlled by a board of trustees which has power to levy taxes for township road purposes and appoint one man who is responsible for maintenance of township roads. In each average Iowa county there are sixteen townships. I wish to add here that those township men appointed by the board are non-experts, they have no engineering ability and receive not more than \$4.50 a day for their services. They nominate superintendents and supervise the work in areas about 6 miles square and expending only under their direction from \$600 to \$2000 per annum. Each county is governed by a board of three to seven supervisors who must appoint a county engineer or engineers, and who have the sole authority to levy the taxes for county roads and for building all culverts and all bridges, on both the county and the township roads. The State Highway Department is a board of three men, two appointed by the Governor and one ex-officio. These men have authority to appoint an engineering corps and office assistants. Under this provision of the law we have 13 or 14 engineers working all the time under the direction of the Highway Commission. The three members of the commission have devoted a great deal more of their time than the law contemplated that they should to putting into effect this law. They limited us to pay for only 100 days in the year. I worked 160 days myself and the other members of the commission appointed by the Governor, who is the owner of several hundred acres of Green County land, worked over 200 days and the chairman of our commission who is Dean of Engineering in the Iowa State College worked perhaps 150 days in putting this law into effect the first year. We have now under the direction of our field engineer and our highway engineers 6 district engineers who have the State under their immediate control for the direction of road work. We have the State divided into 5 districts and a man in each district to supervise and direct the work of the county engineers, and in addition to that we have one man who is a district engineer at

large, practically, although he will be assigned a district soon. We have another engineer who puts in all his time at the work of making surveys and plans for the elimination of dangers at grade, undergrade and overgrade railroad crossings. The county engineers are appointed by the board of supervisors, but are liable to removal by the highway commissioner for any cause that the highway commissioner may deem proper. Up to this time we have removed about 20 county engineers. At the beginning we found an inclination on the part of supervisors to honor the memory of a lot of county surveyors by making them county engineers. A number of these men had to be removed. Several others accepted the suggestion that it was nearly time to resign, and now we have county engineers, one at least in each county and in some counties two, who are more or less competent although there are removal proceedings pending against perhaps a dozen or more at this time which will probably come to a termination against the county engineers before the first of the year or before the work begins next year. The Iowa law does not provide for any merit system in the selection of highway engineers or the county engineers but we have put into effect such a principle in a merit system of our own since the beginning. We were accused when we started out of being engaged in the occupation of creating offices, soft snaps they were called and considered—for the graduates of the Iowa State College—but the fact of our year and a half's work disproved that charge. We now have in our force a number of men, I am not able to tell exactly the number, who are not graduates of any college, or university within the State, and many more who are not from the institution with which our highway commission is connected by being located in one of the buildings and having the Dean as chairman of the commission. The county engineers have been drawn from all parts of the country. We took the county engineer of Buchanan County, Missouri, for one of our county engineers and we had thrust upon us the assistant engineer of the State of Nebraska as the county engineer and there are engineers at work in the State from all parts of the country. We got most of our efficient engineers from the railroad companies. At this time the railroad companies in our State are letting out their engineers and we have possibly 25 engineers that have come to us within the last year from the railroad companies. Those men are almost always proven to be very efficient in the work that is put under their charge. The plan of operation is as follows: All roads are divided into two classes. The county roads which are the main traveled roads, constitute a definite system in each county of not more than 15 per cent of the mileage and these county systems are interconnecting at the borders with the other county systems so that a county system of 16,000 miles of interconnected highways constitute a primary or county highway system. Being continuous as they are through the counties the county systems form one great State system reaching every trading point in the whole State. These roads were selected pri-

marily by the board of supervisors of each county, but the commission was charged to the duty of receiving all protests, and of finally passing upon each system to make a continuous State system. About two miles of road were petitioned for, for each one mile that could be established. The system thus established constitutes a definite mileage that must be improved by the county before any change may be made or new roads added to the system. The remaining roads are placed in the local or township systems. Each local system is under the direction of the board of trustees and the township road superintendent, who is charged with certain definite duties among which is the continuous dragging of the roads, for which a non-divertible drag fund is levied by the townships. It might be interesting to many of you to know that under this division of county and township systems, that in some of the counties where the supervisors, backed by a certain per cent of public sentiment, have resisted the operation of this law, the townships have gone ahead under the law and done better than the counties have been able to do in the building and maintaining of better roads. The township trustees, in many instances, have shown the county boards the better way of building roads in the townships in the same county where the board of supervisors was resisting the new law. All bridges and all culverts on both systems are built by the board of supervisors. The State Highway Commission has general supervisory powers over both county and township boards, with power to enforce provisions of the law. All officials from the State highway commissioners to the local road superintendents are bonded officers, and responsible under these bonds for the performance of their duty. The whole frame work of the law is founded upon one general principle, that is the fixing of responsibility for each and every bit of work that is to be done in the construction and maintenance of adequate primary and secondary highway systems. Without going into the details of the operations and considering the fact that the law has only been in operation for one year, and that many problems must be met in the future in an administrative scheme that reaches down to the most unimportant road official, the following is a summary of the results which are being accomplished under the policy of State control without State aid:

First: Each mile of road, each culvert and each bridge is under the immediate supervision of some one man who is responsible on his bond for the proper condition of that particular item. If this official fails to perform his duties an appeal may be taken to the Highway Commission, which has full power and authority to enforce the provisions of the law.

Second: The road work has all been divided into certain definite classes and plans have been standardized for each class of work throughout the ninety-nine counties. For example, the profiles and sections for permanent road grading are made up in exactly the same form in each of the ninety-nine counties.

Third: Every piece of permanent road work is approved by the district engineers of the Highway Commission so that the same sections, maximum grades and finished product are secured so far as the topographical formation of the counties will permit.

Fourth: Culvert and bridge plans have been standardized. Standard plans and specifications are supplied to all of the counties by the commission. The adoption of uniform standardized plans is resulting in a more satisfactory class of work at lower prices.

Fifth: The system is predicated upon the appointment of a capable county engineer. The commission has the power of removal if the engineer fails to carry on his work efficiently. Already there have been changes in a number of counties in the interests of efficiency. This means that eventually there will be a strong class of county engineers who have broad constructive duties to perform.

Sixth: A uniform system of records and cost keeping and blanks have been supplied by the commission to all of the counties and townships, and each year a detailed report will be made by the county engineer of all the expenditures of road and bridge moneys in each county.

This law is essentially an earth road and permanent bridge measure. Within the funds available a large mileage of gravel surfaced roads can also be constructed. Some few stretches of the more permanent types will be built, but the system so far provides mainly for earth roads and permanent waterways. For a State such as Iowa, which has a fairly uniform distribution of population and in which the wealth is also quite equally distributed, there has suddenly come a demand for a large mileage of roads that will not only serve the market purposes but the intercounty needs as well. There are registered in the State over one hundred and ten thousand automobiles. This traffic alone has created a demand for and a sentiment in favor of improved roads, but the demand is for a large mileage rather than a small mileage of more permanent types of road surfaces. Under these conditions the policy of State control without State aid it is believed will secure these results quickly. Whether a policy of State aid is adopted or not, under the present system there is being built up an organization which will be capable of handling the more expensive types of road construction if the State concludes to establish the policy of State aid appropriations and appropriates large sums for permanent road construction. If this policy is not adopted, then permanent road construction will be developed in districts, and under this plan State control, issuing proper standards of materials and methods and efficient local engineering, will justify State control without State aid by the results obtained. [Applause.]

THE CHAIRMAN: The meeting will now adjourn until 10 o'clock tomorrow morning.

November 11, 10 a.m.

MR. JOSEPH W. HUNTER IN THE CHAIR

THE CHAIRMAN: The convention will please come to order. We will take up the program for the session. I want to say in this connection that I regret very much that Mr. Bigelow, State Highway Commissioner of Pennsylvania was unable to attend the session of the Congress. He has, however, sent me to represent him and in opening up this meeting I have a few remarks to make along the line of the subject that he was to take up, namely, construction and maintenance. I certainly appreciate the honor of having the privilege of being at this Congress and attending its sessions.

A twofold subject, any one part of which is a subject in itself, a proper treatment and presentation of which would require more than the allotted time for the presentation of such a paper.

First of all is the proper location of the road or highway that is to be improved, then comes the drainage and the proper construction of the subgrade or foundation. With these two requisites properly taken care of, the balance of the construction work is a matter of detail. Without proper drainage and the proper construction of the subgrade it is useless to construct or erect the road bed. Many contractors are beginning to realize that it pays them much better to give more attention to the proper drainage and construction of the subgrade of the road than to hurry through with this portion of the work than to have to go back and do the work over because of the failure of the metal and surfacing has been placed thereon. No building that is intended to be permanent will stand long on a poor or shaky foundation.

The work of maintenance is the larger and broader field, while the problems in construction are many, yet most of them have been, and others will be readily solved. But maintenance work is newer and the problems more varied, and on the whole of more importance; of course, much depends on the material used in the construction of the road, particularly in the surfacing. As eternal vigilance is the price of liberty, so is eternal vigilance or constant watchfulness necessary in the maintenance of any reconstructed or improved stone road. The historic stitch that saves nine means in road maintenance a shovel full of stones here, a shovel full of earth removed or placed, at the proper time, a ditch or culvert cleaned out or opened up. It costs less to properly and constantly maintain a road or highway than to neglect it, allowing it to become worn out and then resurfacing it.

The maintenance of the improved roads in Pennsylvania is being done by the State Highway Department with its own equipment and labor, at less cost than by any other method. The question of securing sufficient labor at the proper time has been a serious problem and will continue to be so until a sufficient number of laborers

can be employed continually. With such a body of trained men, better results can be obtained at less cost.

The maintenance of the 8000 miles of State highways, some of which are improved stone roads, but the majority of which are earth roads, is under the care of a maintenance engineer, and fifty superintendents; as is the maintenance of about 1500 miles of State aid roads.

In addition to the above work the State Highway Department was given by an act of assembly at the 1913 session, general supervision of upwards of 80,000 miles of earth roads. These roads are primarily under the care of three men, who are designated as a Board of Township Supervisors. These men are elected for a term of six years, one being elected every two years, this making a continuing board.

The writer was under the provision of the act appointed by the State Highway Commission to organize and take charge of the Bureau of Township Highways.

The first step taken was to get in touch with more than 4600 supervisors of the State by forming them into 66 county organizations under the provisions of an act of assembly which authorized the formation of such associations. Each association has its own officers, by-laws and rules which provide for one to four meetings per year.

At each of these meetings information was furnished to and instructions given to the supervisors, rules and regulations which the supervisors are required to observe were adopted, a uniform system of accounting established, all books and forms being furnished by the State; bulletins of instructions prepared and sent out, an engineering corps organized for the purpose of making surveys upon requests of townships that desired to change the grade of a road or to reconstruct an earth road as a stone, brick or bituminous road; also to stake out bridges, plans for which are made by the Bridge Department. Surveys, bridge plan and all work done for township is at the expense of the State. Upward of fifty road surveys have been made and two hundred and fifty bridge and culvert plans have been furnished in less than a year.

Upon compliance with the provisions of the law and with rules and regulations of the State Highway Department, each township is entitled to receive 50 per cent of the amount collected in cash, the work tax has been abolished, for the maintenance of the earth road, and in the maintenance of bridges, or in the reconstruction of earth roads as stone or brick or bituminous roads, or in the reconstruction of bridges, provided that the sum to be paid by the State shall not exceed \$20 per mile.

The total amount collected and expended by the several townships in the State for the year 1913 as shown by the annual reports of the several Boards of Township Supervisors is \$5,410,424.27. About 13 per cent of this amount was expended for collecting and

disbursing. The board of supervisors serve without compensation but are allowed their necessary expenses. Hereafter township supervisors must show that they have expended for some permanent improvement of their roads a sum equal in amount to the sum received from the State.

This hasty sketch has been given to show that Pennsylvania is now starting in the right direction to obtain the improvement of the earth roads in the State. Because of the information furnished and advice given a noticeable improvement has been made in many sections of the State. There has been some antagonism shown on the part of the few township supervisors, but the great majority of them are in favor of the changed method and new system.

Good township government is seldom obtained on purely party lines. Party politics should not be allowed to enter into the organization of any State, County or Township Highway Department. Get the best men possible from your home State, county or township if practicable, but get good practical men, no matter where they may come from.

While the Pennsylvania State Highway Department employees are not under civil service, yet it is the rule of the commissioner that the man who has shown proficiency is the man who is retained and promoted. More than a majority of the division engineers have been with the department for about nine years, some of them have been promoted to maintenance engineers. Assistants to division engineers have been made division engineers and their places filled by promoting transitmen, and so along the whole line. Of the fifty superintendents of State highways, but few are engineers. They were selected from among men who had been supervisors and from among others who had some practical knowledge of road work, some changes had to be made until the superintendents, as a whole, are a good practical lot of men. Many of the inspectors of construction work are others than engineers, in fact, some of them make better inspectors than the engineers, they being more practical and seem to use their common sense to better advantage. Anyhow, about 90 per cent of road work is common sense.

Much can be gained by having at least an annual meeting of all the men in the employ of a State Highway Department, a semi-annual meeting, perhaps would be better. It is coming together, the touching of elbows, the exchange of thoughts, the discussion of methods that make for the efficiency of the whole organization, and help many a timid fellow over a hard place. The old motto "In unity there is strength" still stands, and will for all times.

THE CHAIRMAN: The first paper on the program is "Rights of Way," by Austin B. Fletcher, State Highway Engineer of California. This paper will be read by Mr. Sohier, Chairman of the Massachusetts Highway Commission.

MR. SOHIER: I am so accustomed in Georgia to your not knowing who I am or quite who I represent that I feel perfectly at home in representing Mr. Fletcher of California, because he originally came from Massachusetts and served with me. He has a topic that will interest everybody who is interested in highways. Most of the subjects interest only a few; dirt roads, sand clay roads, macadam roads and various bituminous macadam roads and pavements only interest people who have money enough to build those kinds of pavements, and most of us in this country have to be satisfied for some years to come with the well maintained, well graded dirt roads, but the right of way is totally different. Men may come and men may go, but if the right of way is not sufficient for all future time, then you as the highway commissioners have been recreant in your duty.

RIGHTS OF WAY

BY AUSTIN B. FLETCHER

State Highway Engineer of California

Adequate "rights of way" of "locations" are of prime importance in any highway system and too little attention has been given to this feature of highway work hitherto.

In the mad haste to get the roads built so that the automobile enthusiasts may use them "while they are yet alive," we are prone to forget that the highway location is the one really permanent feature of the road work.

The time to secure proper locations for the roads, and widths sufficient to serve all purposes for long years to come, is now. If we wait until some future day to correct improper locations, and to secure suitable widths of rights of way when we have more leisure, we will have wasted much money in pavements constructed and the land needed will cost much more and will be more difficult to acquire.

It goes without saying that all land owners are more complacent in giving up portions of their property to the public before the improvements are begun than at any time afterward.

In some of the older States the people came long before "sectionalization" by the government was thought of but in the Middle West and on the Pacific Coast, most of the land was divided years ago "checkerboard" fashion by the government surveyors.

The highways in the older States were laid out, or in most cases, simply grew where the travel wanted to go but in the flat prairie land of the west, and even in the Pacific Coast valleys, the roads were often, if not generally, laid out straddling the section lines, the center of the right of way being usually coincident with the section line. This plan had the merit of lessening the area of land deducted for road purposes from the holding of an owner by making his adjoining neighbor provide one-half of the land required for the roadway.

This method of road location often proves to be an embarrass-

ment to the present-day road builder since this time-honored rectilinear scheme does not fit the present needs. Centers of population often times have not occurred in conformity to such a plan; often the railroads have determined the location of the towns. In such cases it is desirable, considering the volume of "through travel" in motor cars and trucks, to construct the roads in the most direct lines possible. This often entails rights of way running diagonally across the sections, "cuts up" land holdings and makes trouble generally for the right-of-way department.

But when the rectilinear plan has been carried still farther and the land owners, to conserve particularly good areas for agricultural purposes, have had in times past enough influence to cause the county authorities to discontinue or vacate portions of ways along the section lines and have introduced right angled turns into the half or even quarter section lines, then the engineer has a task worthy of his mettle to secure a proper location for his improved road.

And if the road be in an orange grove section, his joy is indeed complete.

The writer knows of a main paved road in one of the California counties which has at least ten right angled turns in it in a distance of about 20 miles and this road passes through no town or city and is practically level. In planning their new highway system several years ago, that county gave up as hopeless the task of securing a direct route in the locality referred to, so for many years to come all through travel over those 20 miles of beautifully paved highway must be subjected to the dangerous right angled turns and to the unnecessarily increased length.

There is reason in cities and other centers of population for ways laid out in rectilinear fashion. In the open country, there is no excuse for planning a new highway system along such lines. Land should be condemned if the owners will not donate it.

There should be as direct a line between important centers as the topographical conditions will permit.

Assuming that the best alignment for the highway has been adopted taking into consideration the factors of topography, climate and traffic needs, present and prospective, the next question confronting the highway engineer is the width of right of way.

It is certainly desirable that in any highway system the right of way be of uniform width but as a practical matter, each link in the system must be considered by itself. Near the centers of population it is obvious that the pavement and the rights of way must be wider than in remote rural communities, sparsely settled.

It is the writer's opinion, however, that for a minimum width of right of way 50 feet is none too much and that wherever possible, a width of 60 feet is the least that should be secured, even in sparsely settled localities.

It is inevitable that street railway, electric light and power, gas, telephone, and telegraph companies will at some time clamor for

locations in the highway, and although too little attention has thus far been paid to the matter, tree planting and other landscape treatment of our country highways will have to be provided for.

In many of the older sections of the country right of way problems are not serious affairs. Ways have been established there, well defined and traveled, for many years, and right of way improvements consist chiefly in rectifying the side lines of locations where abutting land owners have encroached successfully under the "open adverse possession" statutes which apply in some of the States.

But in many localities, the acquisition of necessary easements of way becomes as important a factor in the plan and progress of highway work as the road work itself.

In the more sparsely settled communities, roads have been built following lines of least resistance, in the valleys the "sectionalized" land lines, and in the hills wherever the ranchers could best spare it. Accordingly, when modern road building methods are invoked, it becomes necessary to alter meandering and precipitous roads by straightening, widening, and improving the gradients. The needed rights of way for these purposes must be acquired.

This feature of the work is particularly annoying to the highway engineer. His desire is to press forward the best line in the best way in the best time. When he is confronted by a hostile, reluctant or indifferent land owner, the engineer usually loses his patience.

It is not alone in cases of new rights of way that there is litigation, but frequently old surveys do not exactly coincide with existing ways, many of which in course of usage have become winding and irregular, and consequently additional land has to be acquired to widen, straighten or alter them.

Owners often build fences or cultivate up to the used portion of the ways and resist the shifting of the lines and delay the progress of the work. In many cases much time is lost where owners who have allowed people to pass and re-pass in vehicles without objection for years, assert adverse claims and work must be delayed to avoid complications.

One has also the experience of attempting to use dedicated rights of way shown on plats recorded in times past but which have been entirely unused or allowed to fall into disuse, and then being confronted by claimants, with their attorneys, who contest the rights of the public therein.

There are many unavoidable delays in obtaining rights of way, arising outside of the disputed rights of way mentioned. Even when the owners intend to be liberal they exact a great deal of information before signing the deeds of easement. The records have to be searched to ascertain the true owners of the lands affected; owners must be notified or corresponded with; draftsmen are asked to furnish sketches to many owners defining the rights of way desired; visits to the lands must be made and surveys inspected; minor adjustments of lines and fences must be settled upon; vacation pro-

ceedings arranged and prepared, abandoning the old roads or portions of roads over property so as to leave no incumbrance on the same when the new road is located and built; co-owners must consult among themselves before executing deeds of easement; owner-ships involved in probate proceedings or title litigation must be searched and a good title to the roads acquired out of the confusion, and there are other details *ad infinitum*.

These many difficulties have led, in the writer's western experience in highway work, to the employment of the subtle right-of-way man, who needs be a psychologist as well as a philosopher. His chief duty consists in attempting to wheedle the often-times contrary land owners into signing the needed conveyances and to convince them, usually, that their duty to the public lies in giving their property gratis. Such an employee becomes a very important member of the organization. His troubles are many.

In addition to the "right-of-way man" and his assistants in the California work, the help and advice of an attorney learned in eminent domain practice has been had who devotes all of his time to the highway work and whose principal activities are in right of way matters. The writer takes this opportunity of acknowledging the assistance of Mr. Charles C. Carleton, attorney to the California highway commission, in the preparation of this paper.

In many jurisdictions, if the deeds cannot be acquired by diplomatic methods, war must be declared in the courts, and the highway board must desist from its efforts to promptly furnish the community with necessary thoroughfares until the courts finally determine that the litigious land owners' holdings may be entered upon.

There is a great lack of uniformity in the different States in the methods of paying or securing the payment of damages in taking property for public highway purposes. Such methods are of course regulated entirely by the constitutions and statutes of the respective commonwealths.

In some States it is not necessary for the authorities to pay for private property taken for public use in advance of the actual taking of possession. The property owner has been provided with a method of making his claim and with a tribunal constituted so that he may enforce his claim and obtain his damages therein.

In such jurisdictions, highway work may speedily progress and the laying out of routes followed by immediate construction. The property owner, if he is dissatisfied with the original offer of payment or the award made to him by the public authorities, may pursue his remedy in the appropriate court even though his land has already been occupied by the public.

The public has the advantage of celerity in the progress of its enterprise; the land owner is protected by ultimate and adequate compensation for his injuries, and in one State, at least, he may wait until after the State highway is completed before he must file

his petition for jury trial, it then being evident to all interested parties just what damage has been done, not only by reason of the land taken but by the road construction as well.

But some States are so unfortunate as to be harassed in their public work by constitutions and statutes expressly requiring prepayment before entry upon the land required for public use.

The writer has had to do with highway activities in two States which have operated under each of these methods, the one having the right to take land necessary for public use in advance of satisfying the owner; the other requiring that if the owner is not pleased with the offer made to him by the public authorities, he may stand back on his property with a shot gun and compel public officers to initiate proceedings in the court and remain off his property until after judgment has been obtained and the assessed damages paid into court for his use and benefit.

In the first mentioned commonwealth, the welfare and progress of the people as a whole are superior to the notions and eccentricities of an individual land owner.

In the other State, the recalcitrant land owner may oppose and delay the vital needs of a city, county or State, as the case may be, and his immediate rights predominate over the requirements of the community at large.

No rights of way, in States having regulations similar to the latter, can arbitrarily be taken by the people before the same, after a vast amount of red tape, have been acquired by donation, purchase or condemnation; that is, a taking cannot be made and compensation and damages adjusted afterwards.

Consequently obstinate land owners are able to "hold up" the community at large until it either pays the demands or contests the question of compensation and damages in trials, the latter usually requiring considerable time, particularly in the case of the belligerent or indifferent land owners residing in other States or foreign countries when long publications of summons are necessary before the suits may be commenced. The western States appear to be particularly oppressed by such roundabout methods of entering upon private property and installing improvements for the benefit and welfare of millions of people.

For illustration, under such a system a large western land owner owning an area equal in size to an entire eastern State may be luxuriously traveling abroad. A county has voted and issued bonds for a large amount to construct important highways. Before the great ranch can be entered upon, except for surveys, a correspondence must ensue between the public authorities and the land magnate. The owner declines to sign a conveyance and the people are compelled to commence proceedings in eminent domain against the absent owner. Before a trial can be had, summons must be published for sixty days, and then follow the tedious court proceedings.

It usually happens that pugnacious land owners demand some

exorbitant sum. The court may upon trial only allow a small percentage of their original claim but during the pendency of the action an important artery of travel may be debarred.

Such a system is absolutely hostile to progress; the people should be greater than the individual.

The writer submits that at this time, when modern highway construction is becoming so active throughout the nation, it is apparent that there should be simplification in the constitutions and statutes relating to the subject of eminent domain, and that this Congress may render invaluable service in assisting to bring about so desirable a result.

Too much attention can be given to the title technicalities of right of way activities. It has been an almost universal practice for public boards performing road work to obtain at great expense exhaustive abstracts of title to ascertain land ownerships.

The writer has had under his supervision the acquisition of hundreds of miles of highway right of way in California where the securing of rights of way could not be made much more difficult, complex or annoying, yet the purchase of expensive abstracts of title has been dispensed with. Out of hundreds of ownerships affected, not one serious complication has resulted from the following plan:

When the field parties are making the original surveys, the chiefs of party usually inquire from the occupants of the land surveyed who the owners or those interested in the property may be. This gives a clue to the ownership. Thereafter, one of the staff visits the proper county offices and ascertains from the assessment rolls or the records who purport to be the owners. Deeds or agreements are then prepared, containing the proper descriptions, and it is very rare, indeed, that any objection has been made to the accuracy of the instrument submitted.

By thus performing its own title searches, even though they may not have always been the most exact from a title lawyer's standpoint, the authorities have saved thousands of dollars and have never had an injunction or ejectment proceeding instituted against them by objecting land owners.

By taking a few remote chances of complaints, work, which would otherwise be hopelessly harassed and delayed in the performance of a highway project, may proceed.

Furthermore, in most States, title may be obtained two ways by user or implied dedication by the passage of time. It has been the custom in California where the present traveled roads are wide enough for use and properly located, to place the monuments and build the pavements and assert jurisdiction thereover, the theory being that if the owner objects, the authority's title being fundamentally weak, the State can "condemn" as rapidly as the alleged owner can "oust."

The so-called State highways in the several States may be divided into at least two classes with regard to the control by the State of

the roads after they are built, namely, those which are maintained by the State and over which the State assumes complete charge from property line to property line with the possible exception of the policing of the way, and those sometimes called State-Aid roads where the Commonwealth has little or nothing to do with the maintenance of the roads and the burden is placed by law upon some subdivision of the State, usually the county.

The writer has had to do only with the class of State highways first mentioned and he believes that the State ought to have as complete control as possible over its highways, State or otherwise. Such control, however, places a considerable burden upon the authority which administers the law.

More is expected of a State organization, and rightly so, than of a county board. Its work must be done carefully and accurately. The surveys and plans of the State highways must be well made and no small part of the engineering costs is chargeable to the careful work needed in running out and establishing the right of way lines.

In trying to establish old right of way lines in anticipation of highway improvements, much difficulty is often experienced in finding any landmarks to indicate what the right of way really is, and the old surveys and plans often prove to be of little assistance. Often the roads to be taken over and built as State highways were laid out when the land was of little value and the surveys were carelessly made or the descriptions carelessly recorded. With the lapse of time buildings, trees, and other similar features, which formerly marked the location of the road, have entirely disappeared, and the traveled ways have shifted from place to place as the action of the elements or the whims of the travelers have directed. Fences, if they exist, have been so moved about that they in no way indicate the original line of the road.

In all State work with which the writer has had to do it has been the policy to fix the right of way lines on the ground by setting proper monuments into the soil to such a depth that they serve as markers for all time to come.

In planning a new system of highways, careful plans should be made and permanent monuments set. Future generations will surely appreciate such records and the additional cost of this kind of work should not forbid.

THE CHAIRMAN: The discussion of this paper will be opened by Mr. W. S. Gearhart, Highway Engineer of Kansas.

MR. GEARHART: Properly located public roads mean so much for the safety of the traveling public, economy in transportation, and the reduction of the expense of up-keep on highways, that all who are interested in road improvement will be very grateful indeed to Mr. Fletcher for the valuable suggestions in his excellent paper on "Rights of Way."

The time to solve the right of way problem, as Mr. Fletcher states, is now. No part of the highway is so permanent as its location and after the location has been firmly established in a certain place no part of the road is so hard to improve as the right of way.

The greater part of Mr. Fletcher's paper has to do with the problems involved where the State Highway Department selects the rights of way for roads on which the State proposes to make extensive improvements, and the methods described are not unlike the best railroad practice, except possibly in the matter of land titles, which the railroad companies are very particular about, for reasons which are evident.

The writer has not been connected with State highway work of this kind, but on railroad location has had all the experiences incident to facing a double barreled shot gun and recalcitrant land owners.

The roads that straddle the section lines are the ones most of the good road advocates in the Central West are especially interested in, for like Mr. Lincoln stated concerning the common people, there are so many of them. Too many miles of roads have been opened in these States. This is particularly so in Kansas, except in the western third of the State, where there is a highway on practically every section line, and in many cases the half section lines have been opened.

With such an established checker-board system there is little the engineer can do in the matter of new road locations without specific authority except to agitate and educate and to parallel the railroads until the State begins to participate in road construction and maintenance.

Those living outside the prairie country no doubt wonder how the highways came to be located astride these imaginary lines. The Central West was surveyed, mapped and the corner stones set, by the United States Government at an early date, and the country was divided into rectangular counties, townships six miles square, sections one mile square, and quarter sections. This provided an easy, practical, accurate, convenient method of making the surveys, fixing the boundary lines and recording land titles, and all deeds at the present time refer to the township, range and section. It also had the further advantage of dividing the farms into the most practical form and it is only natural that the owners of these farms should insist that the land be not cut up by diagonal rights of way—hence the section line roads.

The trails, military highways and other early roads of Kansas were located by the old plainsmen, and the United States military engineers, on the most direct routes and on the best ground available, as Mr. Fletcher is insisting that the State roads in California shall be today.

One of the territorial road laws of Kansas, enacted in 1860, reads in part as follows:

That each territorial road shall be laid out from the place of beginning to the place of termination on the most direct route, where suitable ground can be found to establish the same.

In 1861 the Legislature of Kansas enacted a law providing for the establishment of forty-five State roads covering all sections of the State. The act specified the cities or towns which each of the several roads were to connect, and named the three men who were to act as commissioners in locating each road. The commissioners were required to locate these roads upon the best possible ground consistent with the most direct and practical route and to as nearly as possible avoid in all cases making two or more angles where good ground for a road could be had upon a direct course with but one angle.

This was a good beginning, and at the present time few States in the Union have statutes governing highway location so commendable as these. Unfortunately, however, in 1861, during the same session of the legislature at which some of these excellent highway provisions were enacted, a special law was passed declaring all the section lines in Brown County to be the centers of the public highways whenever any road was opened for traffic by order of the county commissioners.

This measure looked innocent, no doubt, for it was entirely a local proposition, and applied only to Brown County. The necessary road surveys and views were expensive, at least they were considered so at that time, even though the cost probably did not exceed \$5 per mile. In one early statute this expense was limited to \$3 per mile. This section line road measure was no doubt enacted in the name of economy, as most of the other blunders in highway improvement are made.

In 1871 the section lines in fourteen other counties were declared to be the centers of the public highways and from that time on the roads have been laid out almost exclusively astride the section lines, regardless of the proper location, hills, character of soil, safety of traffic, first cost maintenance expense, or convenience or economy of traffic, and now only in rare instances is any part of the original trails or territorial or State roads left, except such as follow the section lines.

In the cattle country of the extreme western part of the State where there are few fences most of the roads used today follow the natural locations on the most direct routes on the high ground. These roads, however, are not legally laid out, and strange as it may seem, when they are officially opened they are almost always bisected by a section line.

All highways at the present time are laid out on petition to the county commissioners by twelve free holders who live in the immediate vicinity of the road. The petition must specify the place of beginning, the intermediate points, if any, and the place of termination of such road. The statute provides that the width of the right

of way shall not be more than sixty feet or less than forty, the exact width to be determined by the viewers at the time of establishing the road.

If the county commissioners pass favorably upon the petition they may act as a board of viewers or they may appoint three viewers to definitely locate the road. Generally the appointed viewers have no interest whatever in the road or desire it to be located on a certain section line, and in either case the interests of the individual land owners prevail at the expense of the public welfare. The statutes do not now require the highways to be located on the section lines, but public sentiment does, which is just as bad, if not worse.

The statutory provisions for locating highways in the other Central West States are not, and have not been, unlike those of Kansas, and the evolution of the section line roads has been the same, always selfish and at the expense of the public.

Some of the advantages of the section line roads are: The elimination of local strife in establishing locations; little or no trouble to get a road as compared with the method of petitioning and viewing; low cost for views and surveys; relatively low damages for rights of way, since such a road would generally be located along the side of the farm instead of dividing it; the lessening of the area of land deducted from the holding of any owner by requiring his adjoining neighbor to furnish half the roadway, as stated by Mr. Fletcher; the elimination of sharp angles in the fields; greater ease in farm operations in the fields adjoining the highways, this is especially true where large machinery is used; the facility with which strangers can follow the highways; and most important, a majority of the people believe that the road should be there, and that no land can be spared for highways any place else.

Probably no enumeration of the disadvantages of the section line roads would include all the objections. However, some of the worst ones are: The resulting large number of unnecessary excessively steep grades, expensive bridges and culverts, dangerous railroad crossings, and sharp angle turns; the practical difficulties in relocations; the increased distance around the two sides of a right angle triangle as compared with the length of the direct road located on the hypotenuse of the triangle; the zig-zag traveling or sail boat like tacking necessary to reach any given point except, possibly, due east, west, north or south; the bad soil conditions often encountered; the high first cost, and expensive maintenance; increased transportation expenses due to the longer haul and extra time required to reach market; nine times out of ten the section line is not located where the road should be and the highway that straddles the section line is nearly always located in the interest of the individual instead of the public.

The practice of section line road location has been followed so long that it is now not uncommon to see all other considerations wholly disregarded. The writer, while employed on some drainage

work straightening a stream, met an old lady who was opposed to the improvement and she gave as her reason that if God Almighty had not wanted the stream located just where it was He would have put it some place else. A good many people seem to have the same opinion of the government made section lines and the location of the highways, as evidenced by the following examples:

A mile of road was recently opened in the rolling prairie country of Kansas on an east and west section line. This mile of road crosses the same stream three times and a more scenic route could probably not be found in any White City. The expense for bridges was about \$5500 and for grading \$2500, or a total of about \$8000 to make the road passable. The highway benefited only four men, whose property is not worth as much as it cost to open the road. By establishing one and one-half miles of north and south road only one bridge would have been needed and the same purpose would have been served at a total expense of about \$2000. The writer advised the county officials in this case to buy the farms and rent them for pasture rather than fasten upon the county indefinitely the maintenance of such an abominable road.

In 1905 a \$2500 bridge was built on a section line and \$1000 was expended for grading. Then the bridge and the work was abandoned and it has never been used, for it will require an additional expenditure of \$3000 to obtain a 13 per cent approach grade. By placing the bridge at the ford on the old natural road only 225 feet off the section line a very good road with a 6 per cent grade could have been had at a total cost of not to exceed \$2500.

Less than four miles from the bridge referred to above another \$1800 section line bridge was built against the face of a rock bluff. The east approach has never been made and on the west end at 130 feet from the end of the bridge the rock bluff is forty-two feet above the bridge floor. About \$150 was spent in quarrying rock to make an approach and then the work and the bridge was abandoned, for the only practical way to make a road at all on this section line at this point would be to construct a tunnel. By moving the bridge 120 feet to the old ford a good crossing and a water grade around the bluff could have been had without any change in the present road. The distance around the bluff is practically the same as over it.

Where the railroads run diagonally across the sections it is not uncommon to see two unnecessary, dangerous, highway grade crossings within a quarter of a mile and often much closer. Apparently it never occurs to the viewers that in such cases the highways should parallel the railroad.

On account of the local influences and the lack of proper information the average road viewers cannot handle this problem of rights of way alone, satisfactorily. The State Highway Department should approve the location of all main roads before they are improved and until this is required by statute there is little or no hope for much favorable change in the States where the highways

ride the section lines except by paralleling the railroads. The streams are too crooked to make it practical to parallel them.

THE CHAIRMAN: We will proceed with the next paper on the program, "Drainage Structures," by Mr. W. E. Atkinson, State Highway Engineer of Louisiana.

DRAINAGE STRUCTURES

BY W. E. ATKINSON

State Highway Engineer of Louisiana

Drainage structures like many other features of highway construction require the consideration of many factors in determining the type and character of construction adaptable to any particular location, or in determining a uniform standard or design to be used throughout any particular proposed highway project. Inasmuch as road construction together with drainage structures are more or less problems to be solved by every State or highway commission to meet local conditions, I shall not attempt to set forth any rules or plans governing the type or construction of all drainage structures, but merely present to you some of the general methods, factors and policies governing the construction of such drainage structures in Louisiana, under the supervision of its highway department.

In determining the length of bridges and spans between bents and piers and the size of culverts, consideration is given to the maximum rainfall, amount of run off, average slope of ground of drainage area, seepage, etc., as included in the same factors governing similar structures under railroad construction. After determining the required opening for waterway, the factor governing the required strength or carrying power of the structure is determined, so far as it is possible, upon the maximum load the structure is likely to be subjected during its bonded life. As to the bonded life of structures of this character, it is figured that they should last until bonds or taxes voted for the construction of same are retired, all structures being computed, however, to safely carry a minimum live load of not less than ten tons, plus 50 per cent impact and a factor of safety of four.

It has been the policy of the highway commission of Louisiana to construct, wherever funds and conditions will permit, permanent structures and adopt uniform and standard plans for bridges and culverts for any particular highway project, however, oftentimes different designs are necessary to meet existing conditions, the type and design of bridges, whether they be of wood, concrete, or masonry, etc., are determined largely by the amount of funds available, and the character and nature of soil for foundation.

Due to the alluvial character of the soil, with the exception of some sections in the northern part of the State, there are instances

where it is not safe nor economical to construct the arch type of concrete bridges; even with some of our girder and slab bridges, it oftentimes becomes necessary to provide pile foundations for the piers, abutments and wing walls. In some places it is necessary these piles be of concrete instead of wood on account of many reclamation projects, now under way, lowering the ground water which would become detrimental to the latter type of construction.

We have found it advantageous and economical to provide, where conditions will permit, a uniform design for all drainage structures, especially for those of concrete construction, that the contractor may use the same drainage forms over and over, permitting thereby much lower bids per cubic yard on such work than otherwise under a system of non-uniform standard designs for such structures, and in addition, many times permitting, without greater cost, greater waterway opening than theoretically computed, resulting in a larger factor of safety, and often providing for some unprecedented rainfall or cloudburst not anticipated. In addition to concrete bridges, the department is building many wooden bridges, both of creosoted and uncreosoted materials, this character of construction predominating in some parishes due to lack of funds for more permanent construction.

The department has installed several types of culverts, that of vitrified clay, cement, concrete, cast iron, wood, corrugated galvanized iron, etc., the type of construction being governed by the available funds and topographical features together with character of soil encountered in foundation, however, where practicable, concrete has always been recommended.

At many places, however, we have found it impracticable and not economical to use concrete culverts and others of a monolithic character, especially in some of the bayous and coulees. In one place in particular, it is recalled, where the foundation in one bayou was so poor that a strip 2 inches by 2 inches by 16 feet was pushed down its full length in the bottom of the bayou, and could have been pushed farther if the strip had been longer. This bayou was 250 feet wide across the top and 25 feet deep, and the only opening necessary was that of an equalizer with an area of some 28 square feet to be filled over with earth, thereby making a bridge of earth and of an equalizer. The equalizer installed at this particular location, was a ten gauge 6 feet diameter corrugated galvanized iron pipe culvert. The entire cost of this combination bridge, if it may be so termed, amounted to \$2,059.27, including an item of \$215.73 for riprap, whereas to have bridged the bayou with concrete, or to have attempted to build a concrete culvert, would have made the cost very much in excess of this amount. The only weak point I see, relative to this construction, is the more or less uncertainty as to the lasting qualities of the culvert from corrosion. This is stated merely to show some of the conditions that have to be met in Louisiana.

Due to débris, drift wood, and other extraneous matter, our high-

way department has adopted a policy not to install any culverts of less than 18 inches in diameter where possible, it preferring that they should be not less than 24 inches in diameter.

No doubt many of you will take issue with me on this point, but my experience has been that culverts of these sizes have proven more satisfactory and given better service, requiring less maintenance both for road and culvert at such places than when culverts of less diameter are used, even though the smaller culverts are ample to carry the water, due to the ineffectiveness of the latter from drift choking and filling them up.

I have yet to find my first culvert that is too large for the amount of water and rainfall to be drained, but many have I found that were too small.

THE CHAIRMAN: The discussion of the paper just read was to have been opened by Mr. S. D. Foster, Chief Engineer of the State Highway Department of Pennsylvania. In his absence Mr. Willis Whited, Engineer of Bridges of Pennsylvania State Highway Department will open the discussion.

MR. WHITED: The paper just read is very interesting to me, but the conditions in Louisiana are very much different from those in Pennsylvania. In Pennsylvania we have a smaller rainfall than in Louisiana, but we have steep slopes so that the water has great velocity sometimes and we seldom have any great difficulty about foundations. Where we do have soft foundations like those mentioned, it is very common practice for us to build a rectangular culvert and make the bottom strong enough to distribute the load over the whole of the bottom. That not only checks the erosion due to the water flowing through, but also distributes the foundation load enough so that there is very little difficulty about settlement. In that case of course the culvert would have to be reinforced longitudinally also, so that if the load was heavier in the middle it would not crack crossways. Now much has been written about the strength, stability, etc., and the proper loading of culverts, but comparatively little literature is available on the action of the water. A culvert has to perform two offices; it has to carry the traffic overhead and it has to carry the water under. Now in providing for that purpose we are very careful especially in Pennsylvania where we have high velocity of water, to arrange it so that the water enters the culvert with as little deflection of the current and as little obstruction as possible. We usually flare or wing walls about 30 degrees from the line of the stream so that it acts really as a juttage and we have to put a wall down at the head, if it is soft ground, to prevent the water getting under it. We often pave the bed of it for the same purpose, but even with our assistant engineers I have some difficulty in persuading them to give the bottom of the culvert all the slope possible. Some of them

insist on making it nearly level and then having the debris accumulate on the underside where they can clean it out. I tell them, "Give it all the slope you can, give the other fellow the chance to take it up." It is a good deal cheaper for the Highway Department if the other man clears away the driftwood and the debris than it is for the department to do it, and in doing so, there is also some difficulty occasionally in preventing serious erosion on the down stream side. We find the erosion due to water is usually much more severe on the down stream side than it is on the upstream side, so that we have to take more precautions with it. I have seen culverts with good paved bottoms grouted in and made in nice shape and the water gets to cutting a little on the downstream side, and then it cuts back and cuts back and I have known that to be cut down four feet, and half of that paving destroyed. But that is a thing that we preach to our men all the time, in season and out of season, to give the water as free an entrance as possible into the culvert, as rapid a passage through as possible and a safe exit after it gets out, in such a way that it will erode the soil as little as possible, and in that way we reduce the cost of maintenance, reduce the necessary size of the culvert and get much more satisfactory results all around.

THE CHAIRMAN: The next paper is by Mr. A. D. Williams, Chief Engineer State Roads Commission of West Virginia.

GRADES AND EXCAVATIONS

CONDITIONS DETERMINING MAXIMUM GRADES—METHODS AND COST OF GRADING AND EXCAVATING— ECONOMIC CONSIDERATIONS

BY A. D. WILLIAMS

Chief Road Engineer State of West Virginia

In the past two or three years stress has been laid upon the subject of permanent roads. Many articles have been written bearing upon the various kinds of surfaces, but the ever-important subject of grade and excavation has received only passing notice. Yet the only permanent thing about a road is its grade and location. The various kinds of surface will yield to the actions of the elements and pass the march of time, but the road once established will become more fixed as the years go by, adding improvements and new property lines to bind it firmly in place. This makes more important the engineering subject of our roads. The establishment of grades and location should be given the greatest consideration.

THE MINIMUM GRADE

The principal factor entering into the determination of a minimum grade is the question of sufficient drainage. Except on fills

over 2 feet the minimum grade should not be less than three-tenths ($\frac{3}{10}$) of 1 per cent and preferably not less than five-tenths ($\frac{5}{10}$) of 1 per cent.

THE MAXIMUM GRADE

There are a number of factors that enter into the maximum grade, but, before attempting to locate any road or to establish any grade the engineer should make a thorough study of the territory to be developed by the proposed road giving due consideration to the following points:

First. What will be the present and future demands of the territory adjacent to the proposed improvement;

Second. What are the possible developments in the territory from an industrial, agricultural, educational and social standpoint.

Third. What part will the proposed road be of a general system of roads reaching to other communities and what will be the effect of the improvement on other sections;

Fourth. The nature of traffic that the road will be called upon to take care of, making due allowance for development, considering the present and future tonnage;

Fifth. The general direction in which the greatest amount of tonnage will be transported, the class of tonnage and the time necessary to move it in order to make it the most marketable;

Sixth. The direction in which the ascending grade will be in comparison with the possible traffic demands;

Seventh. The maximum load that a horse can pull based upon the length of grade and the time required to make the trip, from the standpoint of the horse and the time necessary to get the best results for the kind of material the country will produce;

Eighth. Consideration should always be given to climatic conditions and to the season that the roads will be required to take care of the heaviest traffic, as well as a study of the foothold for horse-drawn vehicles. The possible amount of frozen or icy weather should be noted in determining a maximum grade;

Ninth. The class of material over which the road is to be made and the cost of construction on the longer distance compared with the steeper grade and shorter distance have a certain bearing upon the subject, because the most important subject in connection with the cost of roads on grades is that of maintenance which increases very rapidly with the increase of grade. Roughly speaking the destructive effect of violent and periodical storms is four times as great on a 5 per cent as on a level ground, and nine times as severe on a 10 per cent as on level grade. Thus if no other factors were to be considered on earth roads alone the cost of upkeep in a very few years would justify the elimination of bad grades;

Tenth. The condition of the right-of-way and the possible chances for disposition of water and drainage are factors of much importance when considering the maximum grade, because on steeper grades the

increasing velocity demands more drainage and greater skill in handling the water, which, if kept on or near the road will soon destroy it.

Eleventh. The consideration of a grade from the ascension is not the only angle of approach in the location of highway grades because important items enter into the descending grade that should be given as much, if not more, consideration than the ascending direction;

Twelfth. A grade should not be steeper than a horse can descend safely in a trot;

Thirteenth. A grade should not be steeper than a team can safely descend with a load that it can handle for ten hours under normal conditions, exerting its normal tractive force.

Fourteenth. The amount of time necessary to descend a grade should be considered making due allowance for the maximum speed that can safely be used on that grade;

Fifteenth. The highway engineer of today must remember that as time passes the motor traffic requirements of the public highway will be more and more exacting. Experiments as to gasoline consumption and its efficiency on difficult grades and materials are now being conducted near Uniontown, Pennsylvania, by Mr. R. O. Gill, Experimental Engineer for the Chalmers Motor Company of Detroit, Michigan. In this connection we have but little data. Some recent experiments made by Mr. H. Kerr Thomas and Mr. D. Ferguson of Buffalo, New York, for the Pierce-Arrow Motor Company, show that the class and kind of surface exert more influence upon the motor-driven truck than the percentage of grade and that it requires practically the same tractive force on a 1 per cent grade in sand and loose stone to handle the same load as it does on a 27 per cent grade on concrete, asphalt, new brick and first-class macadam. But observations of the speaker lead to the conclusion that grades of any length exceeding 5 or 6 per cent are not as satisfactory and as economical as lighter grades for motor traffic owing to the increased hazard, increased consumption of gasoline, and loss of power due to the resistance to gravity. The speaker's observation further concludes that in frozen or icy weather motor traffic is extremely hazardous on grades exceeding 10 per cent, and entirely unsafe on grades exceeding 16 per cent;

Sixteenth. Grades crossing a summit should merge into each other by some form of vertical curve. The speaker has been accustomed to using the following formula which proves satisfactory and practicable. Take the summit grade at e and a grade point 100 feet on each side or any other desirable distance and by use of either one of the following formulas find the elevation at f which will be half-way between e and g , then by use of the formula find the offset from the tangent at each of the ordinates. This subtracted from the elevation of the ordinate will give the true elevation of the grade.

By reference to Gillespie whose work contains about all we have upon tractive power of a horse, which embraces the experiments of Sir John McNeil, Sir Henry Parnell, and Mr. Cayffier, some of whose works are quoted by nearly every writer, we find that a horse traveling at the rate of two and one-half miles per hour can exert 10 per cent of his weight, and travelling at the rate of four miles per hour, can exert 6 per cent of his weight. These observations prior to 1850 and just before the advent of the steam road into our field of engineering embrace about all the experiments we have excepting the work of Mr. E. B. McCormick of Kansas State Agricultural College and the works of Prof. J. H. Waters of the University of Missouri, and other work by Mr. McCormick is now being done for the Office of Public Roads, at Washington. The speaker's personal observations have shown that a horse for a limited period can exert one-fourth and sometimes even greater percentage of his weight, this depending in a measure upon the kind of shoes on the horse and the foothold on the grade. A horse on a road material that offers safe footing can be safely trotted down a 5 per cent grade, but cannot be trotted down this heavy a grade for any great length of time without injury by "jamming or stoving him up." Therefore, the ruling grade should not exceed 5 per cent, if for a horse-drawn vehicle over which speed must be made on the descending grade because the average horse in walking down a grade will not make over four miles per hour, while he will trot twelve miles per hour, thus, from this standpoint, we can double the distance of the road and increase the time $33\frac{1}{3}$ per cent. The speed of twelve miles per hour should not be undertaken down a grade of more than 3 per cent with a vehicle bearing any kind of a load. In ascending a 5 per cent grade the capacity of the team is about four-tenths of its capacity on level ground and about one-fourth of its capacity on 10 per cent grade, on a loading for the same tractive exertion, but a point here that should not be forgotten is that for a short duration a horse can exert from 25 to 40 per cent of his weight, thus doubling and quadrupling its normal tractive force and in this connection it is often economy, considering the financial condition of the community to put in a short piece of 6 and even 7 per cent grade, than to expend a large amount of money in making an exhaustive and expensive cut, especially so if the cut must be made at the expense of development in some other part of the community. One thing that should be borne in mind is that each year's development of our country makes the chances for changing of grades and their elimination less possible, and that while the improvement of the surface of a road increases its tractive efficiency about 200 per cent on level ground it only increases about one-fourth for a horse-drawn vehicle on a 10 per cent grade, thus money expended in decreasing the grade within a reasonable amount of distance is the best possible investment.

Then with these conclusions drawn and a decision as to the kind

of surface that will possibly be placed upon the road at some future time, we are in position to determine what should be the maximum grade.

METHODS AND COSTS OF GRADING AND EXCAVATING

This is a machine age and wherever grading can be done by machinery it is usually more economical. The following table based upon figures taken from different pieces of work is approximately correct to a wage scale of 15 cents per hour and capable supervision.

Picking 5 cts., Plowing 2 cts., Steam plowing 1.5 cts. per cubic yard. Hauling by wagon approximately 35 cts. per cubic yard. Hauling by trucks and tram 14 cts. per cubic yard.

DISTANCES HAULED	COMPARATIVE COST PER CUBIC YARD FOR MOVING EARTH WITH								
	Wheel- barrow	Drag or Slide Scraper	No. 1 Wheel Scraper	No. 2 Wheel Scraper	1 Horse Cart	Wagon	Tractor and Trucks	Grader	Casting Over Bank
<i>Feet</i>									
100	\$0.057	\$0.090	\$0.100	\$0.100	\$0.056	\$0.095	\$0.080	\$0.022	
200	0.114	0.135	0.130	0.125	0.068	0.103	0.080		
300	0.170	0.180	0.160	0.150	0.080	0.111	0.080		
400	0.230	0.225	0.190	0.175	0.090	0.119	0.080		
500	0.285	0.270	0.220	0.200	0.101	0.127	0.080		
600	0.342	0.315	0.250	0.225	0.112	0.135	0.080		
800	0.457	0.405	0.310	0.275	0.135	0.151	0.080		
1000	0.570	0.495	0.370	0.325	0.160	0.167	0.090		
1500	0.857	0.720	0.520	0.450	0.214	0.207	0.090		
2000	1.143	0.945	0.670	0.575	0.271	0.247	0.100		
3000	1.713	1.395	0.970	0.825	0.388	0.327	0.100		
4000	2.280	1.845	1.270	1.075	0.500	0.407	0.100		

Loading by hand

	0.050	0.010	0.010	0.010	0.130	0.130			0.100
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Loading by steam shovel

					0.060	0.060			0.060
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By a glance at the figures it will be seen that at 22 cents per yard or at the same cost for any given ratio the ratio cost distances are for wheelbarrow, 200 feet; drag scraper, 400 feet; wheel scrapers, 500 and 600 feet; one horse cart, 1500 feet; wagon, 1800 feet, while tractor and truck on track do not reach the amount within one mile. The cost of grading depends materially upon the class of material, the location and the management of the operation. In McDowell County, West Virginia, a contractor failed on a contract at 65 cents per cubic yard, for a material running about 60 per cent soft sand-stone rock, and 40 per cent earth. The county purchased a steam

shovel and moved the material at a cost of 19 cents, including explosives, drilling and shooting. This was casting work on heavy hillside grade. Thus the contract price to the county was \$13,000 for the 20,000 yards. The cost of the labor and explosives, upkeep of the machine was \$3800. The cost of the machine including drill and compressor was \$5500, or a total of \$9300 including the cost of the machine, leaving the county a profit of \$3700 in cash and the equipment.

In Marion County, West Virginia, a contractor recently contracted for a piece of work unclassified at 46 cents and the work cost 52 cents, this was done by steam shovel, being about 70 per cent rock and 30 per cent earth.

In Mercer County, West Virginia, Walton and Company have contracted for grading of nine miles of road at 48 cents per cubic yard unclassified which work is running about 7360 cubic yards per mile.

In Pleasants County, West Virginia, material running about 80 per cent rock, and 20 per cent earth costs 83 cents per cubic yard to grade by day labor at 20 cents per hour, teams at \$3.50 per day. On the same piece of work with prison labor on the honor system which costs 75 cents per day and teams \$3.50 per day, the grading cost 30 cents per cubic yard.

In Kanawha County, West Virginia, the Atlantic Bitulithic Company has a contract for three miles of road grading and surfacing. The grading is contracted at \$1.25 for stone and 34 cents for earth classifications running about 70 per cent and 30 per cent earth, or an average of 97.7 cents per yard. The State has a prison camp working on the honor system under a competent engineer and is moving the same class of material at 24 cents per cubic yard.

Then as to methods the speaker would suggest the use of machinery wherever possible under competent supervision and under proper direction and to make use of the State and county prison labor. On work that is light and on which machinery can be employed the work should be done by day labor. On heavier work and large quantities the speaker would recommend contracting and to the contractor a systematic organization of his work so as to get the most efficient service from his men and equipment. There are volumes written covering the subject of Cost Data in heavier work but the speaker's experience in highway work leads to the conclusion that there are many elements entering into the cost of highway construction that are often overlooked when comparing this class of work with heavier work. One point of deficiency that has been noticeable and should be emphasized here is the lack of organization in highway construction in the various sections of the country. In many instances 50 per cent of the cost could be saved by an adequate organization.

ECONOMICAL CONSIDERATIONS

The economical phases of highways and highway construction are many, and call for more time than the speaker should occupy. We might say that in studying the history of highways and highway economics that it can be divided into three periods: The Roman or Ancient Road, the Telford and MacAdam period, extending from 1750 to about 1840, and our modern or twentieth century awakening. The Roman road with its 3 feet of stone was reduced about one-half in the days of Telford and MacAdam and now with modern machinery we are constructing macadamized roads in West Virginia at costs ranging from \$1000 to \$4000 per mile, concrete from \$7500 to \$12,000 per mile, and brick from \$9,000 to \$20,000 per mile. It should be borne in mind, that the cross section of a road should be so as to permit the greater portion of the work to be done by machinery on ground where machinery can be operated, and that an extra width of the road on hillsides increase the cost. A road on hillsides should not be wider than is needed to care for the traffic. In county districts a 9-foot concrete bituminous or brick or a 10-foot macadam with 5 feet of earth on each berm will meet all the requirements at much less cost.

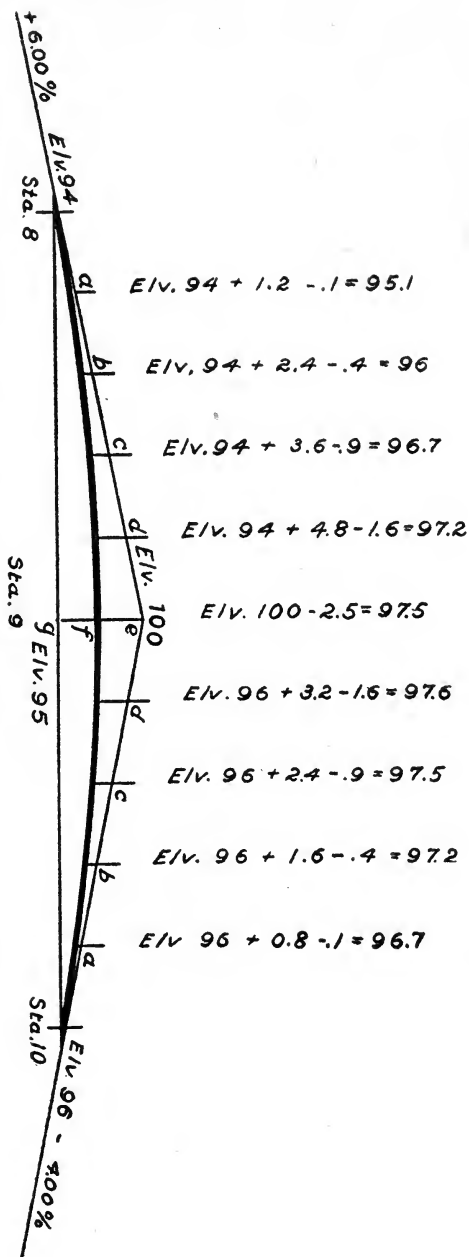
On ground free from roots and stone, where a road machine can be used the material can be moved at a cost of less than 5 cents per yard, and on hillside grading where the work is casting a small steam shovel is an economical machine to use. With this should go a drilling outfit and attachments so it can be operated with the same power. Barbour County, West Virginia, this season purchased a tractor and heavy grader for each district, equipped them with drilling outfit and with less money than they expended in 1913 without showing visible improvement upon their roads and have graded nearly all of the roads of the county in good shape.

In conclusion I want to say that the most economical thing a community can do is to improve its roads so as to serve all its demands and to do this, it should employ a competent highway engineer to make a careful study of the needs of the territory, its financial ability to construct and maintain a road and to locate and superintend the construction of their road for them. When the road is constructed a competent patrolman should be placed on it to continually keep up the maintenance and repairs. Many of our paths and by-ways were not located by men or by engineers but were the foot-prints of the primitive mound builders, the buffalo, the deer and the wild animal that wandered to and fro in the wildwood. Thus our roads need revising because

One day through the primeval wood,
A calf walked home, as good calves should;
But made a trail all bent askew,
A crooked trail as all calves do.

Since then two hundred years have fled,
And, I infer the calf is dead.
And from that day o'er hill and glade
Through those old woods a path was made;
And many men wound in and out,
And dodged and turned, and bent about
And uttered words of righteous wrath
Because 'twas such a crooked path.
This forest path became a lane,
That bent, and turned, and turned again;
This crooked lane became a road,
Where many a poor horse with his load
Toiled on beneath the burning sun,
And traveled some three miles in one.
And thus, a century and a half
Trod in the footsteps of that calf.
The years passed on in swiftness fleet,
The road became a village street;
And this, before men were aware,
A city's crowded thoroughfare.

And soon the central street was this
Of a renowned metropolis.
And men two centuries and a half
Trod in the footsteps of that calf.
Each day a hundred thousand rout
Followed the zigzag calf about;
And o'er this crooked journey went
The traffic of a continent.
A hundred thousand men were led
By one calf near three centuries dead.
They followed still his crooked way,
And lost one hundred years a day;
On some roads the first engineer
Was a wild beast or fleeting deer,
Road Builders, be sure when you laugh,
That you're not trailing a calf.
For such a reverence is lent
To well establish precedent,
That men are prone to go it blind
Along the calf paths of the mind,
And work away from sun to sun
To do what other men have done.
They follow in the beaten track,
And out, and in, and forth, and back,
And still their devious course pursue,
To keep the path that others do.
But how the wise old wood gods laugh
Who saw the first primeval calf.
Ah! many things this tale might teach
But I am not ordained to preach.



$$\frac{1}{2}(94+96) = 95$$

Each Slope is divided into five equal parts

$$\frac{1}{8}(6-47) \times 2 = 2.5$$

$$\text{Second Method } \frac{1}{8}[100-95] = 2.5$$

$$95+2.5 = 97.5 \text{ Elev. f.}$$

$$\begin{aligned} a. a. &= \left(\frac{1}{5}\right)^2 \times 2.5 = 0.10 \\ b. b. &= \left(\frac{2}{5}\right)^2 \times 2.5 = 0.40 \\ c. c. &= \left(\frac{3}{5}\right)^2 \times 2.5 = 0.90 \\ d. d. &= \left(\frac{4}{5}\right)^2 \times 2.5 = 1.60 \\ f. f. &= \left(\frac{5}{5}\right)^2 \times 2.5 = 2.50 \end{aligned}$$

THE CHAIRMAN: The discussion of Mr. Williams' paper will be opened by Mr. William R. Roy, State Highway Commissioner of Washington.

MR. ROY: I have been asked to lead the discussion on Mr. Williams' paper "Grades and Excavations." I have no disposition to criticise Mr. Williams' findings. He has handled his subject with skill, and in a very painstaking manner, and I am sure that you gentlemen who have had the privilege of hearing him feel well repaid for your time.

The question of grades is a very important one, and we in the State of Washington find the extremes confronting us on every hand, and on account of the topography of our country we are compelled to keep close to water grades, hence we cannot make our locations on section or township lines, except in very rare cases. We have a large State in which are more than 40,000 miles of roads without counties, the winding calf trails that Mr. Williams refers to.

We are fortunate in our State to have a governor, who is not only a road enthusiast, but a practical road builder of large and varied experience, and being chairman of the Highway Board is a tower of strength to the working force of the department. The other members of the board are equally zealous and enthusiastic and under their guidance we have during this biennium completed 233.5 miles of State highways, and we have completed 442 miles of permanent highways. This represents most all of the different types of surface. In addition to the above the counties have built during the biennium 1900 miles of road, or a grand total of State and county roads of 2343 miles of roads. The State roads are cleared and graded, ditched and drained to standard plans with concrete culverts—bridges designed to take care of future traffic. Our maximum grade is 5 per cent. We have just completed a section of the Sunset Highway over the Snogalini Pass in the Cascade Mountains. There is no grade on this road exceeding 5 per cent. This was a gigantic undertaking, but with an efficient engineering force and the coöperation of a competent contractor we have exceeded our expectations, and opened for tourist traffic next year across the State that the people of the State and nation will be proud of for all time to come. The scenic beauty along this road is unsurpassed anywhere in the world. The drainage problems in our State have to be handled according to local conditions. Formula used with satisfaction in eastern Washington where there is light rainfall would not be adequate on the west side of the State where there is very heavy precipitation. There we are compelled to spend a great deal more money per mile for drainage.

During this biennium we have expended for State roads \$2,000,000, for permanent highways \$3,264,091, and in addition to the above expenditure of State moneys the counties have expenditure for new construction \$4,533,000 and for maintenance during the same time

\$3,220,000. Taking the total mileage in the State the cost of maintenance is about \$43 per mile. Most of the counties in the State are well organized for helping the cause of road building, and the Highway Department has been fortunate indeed to have had the hearty support and coöperation of all the county commissioners, engineers, supervisors and good roads associations all over the State.

THE CHAIRMAN: Secretary Pennybacker has a letter he desires to read.

THE SECRETARY: This is a letter just received from President Woodrow Wilson:

Mr. Austin B. Fletcher, President of the Fourth American Road Congress, Atlanta, Ga.

MY DEAR MR. FLETCHER: I regret that I am compelled to forego the pleasure of attending the Fourth American Road Congress. May I ask you to convey to the members of the Congress my deep interest in the important work they are striving to promote? I need scarcely emphasize the social and economic importance of good roads. They are prerequisite to the betterment of rural life in a number of directions. Improved roads, especially improved community roads from the farm to the nearest railway station, are an urgent necessity. They are essential for the economical marketing of farm products, and for the development of the educational and social institutions of the country. As important as the matter of providing additional funds may be even more important are the matters of better road administration and the better maintenance of roads already constructed. The nation is now expending more than \$205,000,000 annually for the construction and maintenance of roads, and it is clear that we are not getting the results we should have. The proper planning for road systems in States, the development of better methods of administration, State and local, and the proper maintenance of roads, will, I am sure, receive peculiar attention from your body. When the people are convinced that they will receive full value for every dollar expended on roads they will be brought more easily to an appreciation of the need for future expenditure and will make the requisite provision. I believe that your body can furnish intelligent guidance in the solution of our problems in this field. Sincerely yours, (Signed)
WOODROW WILSON.

The White House, Washington.

MR. MURPHY (of Pike County, Ga.): *Mr. Chairman:* In looking over the list of distinguished speakers at this Congress I fail to find any of the ear-marks of the farmer, the man who is more intensely interested in good roads because it is the foundation and

the bed rock of all development and uplift of the agricultural interests of this country; I mean the farmer who lives, moves and works upon the farm and is dependent upon the results of those farm operations. If I did not fear that I would shock my hearers, I would claim that this good roads movement is of far more interest to the farmers of the South than any coöperative bank loan or government aid to relieve the present conditions, for just so far as the farmers' obligations are increased in connection with present conditions, just that far will you distract his brain and energy from farm operations of the future which are so necessary for his success. But in travelling over this State from near the line of Florida to the line of Tennessee, I find that wherever there is a short stretch of good road, upon that you see farm homes that are attractive, upon that you see commodious barns, you see fences well kept up and painted; you see flowers in the front yard and everything is an evidence of thrift and good living. The land surrounding these farm homes is worth \$50 to \$200 per acre. On the contrary when you reach a stretch of road where it is almost impossible for a team to pull one bale of cotton, you see the farm home of the past occupied by negroes, falling down, dilapidated, the barn consisting of a little log house of about 10 x 15, the fences falling down, if you find any; the grass is growing up to the front steps of the little dilapidated residence; the land around such a habitation has no market value; no one wants to live in a community where it takes all of his motive power to carry one bale of cotton to market. Now I have a few criticisms to pass upon the road work of the present. I believe in reducing these things down to hard tacks. The farmer is the man who is dependent entirely upon the dirt roads of rural districts. What is the road work of the present? Simply temporary; it is dry weather road work. Your road force goes along today, grades the road if it grades it at all, crowns it up, irons it over with a scraper and leaves it. What is the result? Tomorrow your rain comes, and for the next ten days the road is almost impassable. That road force will not get back to that road for something like a year or two years. Not only that, but here is an elevation, there is a depression, there is another elevation; he crowns up his road and runs all of that surface water down to the depression and makes no disposition of the water collected there. And there is a gully washed across the roadway for the unsuspecting automobilist at night and away goes his front axle and spring. Now that is what I see in traveling over Georgia; that is the result of the road work we are getting; that is the kind of work our taxes are going to support. Again, maintenance—oh, there is the key to the situation. I refer in all of my criticisms to sand clay and clay sand roads. That is the only practical and feasible thing for our rural districts for the present at least, so my criticism will be on that class of roads. Now this question of maintenance—there is not a single county in the State of Georgia to my knowledge where a systematic provision is

made for maintenance and up-keep of the roads of Georgia. They go ahead with their initial work and then it all looks nice and smooth, but as I stated a while ago, the rain comes and here goes your expenditures of thousands and thousands of dollars for road work. I want this Congress to impress upon those men who have in charge the actual building of the road, the important fact that the up-keep is more important than the initial work. Now, Mr. President, what I want to see is a school to teach road builders of this country how to build a road; that should be the intent of your Congress. Create a school; they are ignorant, they don't know how to build a road, but they think they do, and won't come here to hear these experts tell them how to build a road. This expert knowledge is fine, I enjoy it. I am so intensely interested in good roads that I would like to hear it for a week, but it is just like the government aid to the farmers and the coöperative bank loans to farmers, it don't reach the man who is in distress. This expert knowledge that you are giving forth here in this convention does not reach the man who moves the dirt, you understand, the overseer, the superintendent. Let us have that kind of an education under State authority, if it is possible, and make it compulsory that he must bear a diploma from this school before he can accept a position as road builder in our country. Thank you.

MR. WILLIAMS: If the gentleman will present his name to the State Highway Commissioner of West Virginia, we will send him a copy of that kind of a law that is already in operation and doing good work.

THE CHAIRMAN: I think there can be no question but what the whole convention is with our friend from Georgia who has just spoken to us. The next paper is "Light Traffic Roads," by Mr. S. Percy Hooker, State Superintendent of Highways of New Hampshire.

SURFACES FOR LIGHT VOLUME MIXED TRAFFIC

By S. PERCY HOOKER

State Superintendent of Highways of New Hampshire

In a subject of this kind the first question to determine is the exact meaning of the title.

What is light volume mixed traffic? How many vehicles are to pass over a given piece of highway and still be classed as light volume? What is their relative proportion as to motor propelled and horse drawn? I confess I am not clear upon the right interpretation of these terms. There are sections of the country where presumably the mixed traffic would consist almost entirely of horse

drawn vehicles, while in others a very large per cent would be motor traffic.

The treatment of the surface of these two sub-divisions would vary to a considerable extent. I am inclined to consider the subject as being the treatment of subsidiary roads which have only the horse drawn traffic originating upon the road, together with motor traffic of the pleasure class and little or no freight traffic which is motor driven.

From my point of view, the word "surfaces" is somewhat superfluous and the subject is the entire treatment, comprising the sub-grade and drainage conditions, which must be considered as part of the surfacing in order to treat intelligently its surface.

I shall treat the subject, therefore, broadly as the improvement of the ordinary country road as it now exists. The purpose being to obtain the greatest amount of linear feet with the least expenditure of money.

With the immense mileage of roads in the United States, it seems to me perfectly clear that even in the wealthier States a large proportion of the roads will never be improved under the types of construction which are now considered necessary for their improvement and that 90 per cent of the entire mileage will be unimproved if it is necessary to improve them with the higher types of construction.

My impression is that there must be a revulsion of feeling which will compel more mileage and lesser cost. Given then a country highway as it now exists and the proposition that for 10 miles of this road there is only available the sum of \$25,000, what can we do to render this really an improved road, which under proper maintenance will take care of the traffic upon it? A preliminary survey may show that a portion of the road is in a low lying level section without proper ditches where at present the natural tendency of the road is to act as a sort of drainage canal for lands adjacent to it. The soil itself consisting partially of leaf mold containing a large amount of humus and which if used as a cultivated field would produce good crops.

The next portion may consist of a sand and gravel formation, containing boulders and on a grade of from 5 to 8 per cent, rolling over elevations and down into hollows and gullies and eventually working out into clear deep sand.

Succeeding this may be a hollow from which you rise upon a side hill cut through a clay bank. Here you face the proposition that the clay is of such a nature as to practically absorb all the water and where your drainage condition is most difficult to handle.

Your last section may be through ledge of native rock or large boulders, the soil slightly covered with either hard pan or sand and upon grades which easily wash under the annual rain falls.

On almost all country roads several of these conditions will ordinarily appear, while of course it is an exaggeration that they will all occur within the 10-mile stretch.

Confronted with these conditions it seems to me to be absurd to attempt a standardization of such a highway in order to economically work out your problem. You must use the material which is comparatively local and the treatment of each section will be different.

The width of the present highway must first be taken up and in general standardized for the ordinary traffic, probably a width of 21 feet between ditches is the most satisfactory standard and considering that this should be accepted as the width of the road, you are next confronted with the alignment and drainage.

In all probability the alignment will be comparatively easy over your level fertile section, but the drainage on this section will be your principal problem. Here in general you must first provide by deep ditching for reducing the water level of the surrounding land and by deep ditching I do not mean the ordinary ditch from which the crown of your road rises, but in many instances a ditch which acts to a considerable extent as a drainage canal.

You must provide culverts at all points where the drainage may be taken away from the road at every accessible point, and however level you may consider the plain or plateau as a whole, you will doubtless find a large number of places by which the water will be conveyed entirely away from the road and bother you no more.

In most instances the grading material obtained from the ditches, though seemingly of very inferior quality, may be used to raise the general grade of your road and if kept dry by the side ditches will compact and make a fair subgrade.

Your next essential is in some way to obtain upon such raised grade a sufficient quantity of metal of some kind to prevent the cutting through of your road surface from water which falls upon the road or in flood seasons cannot be entirely carried away by your ditches. On my plan this may be obtained from either fields, stone fences or even drawn from section two, which has an entirely different soil. In some places it would be necessary to practically lay this stone as telford. In other places it is enough to simply dump it in the road and only partially place it by hand labor. In many places where a roller is available this may be the method and the stone simply forced into the soft material which you have excavated from the ditches and which has not as yet thoroughly dried out from the service rendered by the ditches.

Now what shall be applied as your surface material? In many places you will find that along or adjacent to the road there are hills or hummocks which contain soil not properly either hard pan or clay, but in many places a combination of each containing considerable metal in the shape of either pebbles or fractured stone, and having obtained your bottom through drainage and the addition of stone so that you are confident your sub-base will be practically dry, you may apply 10 inches of the material containing a small amount of metal and by the use of road drags and road hones bring

this first into section and next into a smooth hard surfacing, which will prove satisfactory in all weather for traffic, provided it has constant attendance and is repeated after every rain dragged with the ordinary road drag. The drag removes every slight rut which may be started and does not allow the water to settle through your weak upper surfacing. The maintenance must be not intermittent, but constant. You may find that you still have a somewhat slippery upper surface in which case it will be necessary to add an inch or two of your gravel or sand from section two. You will find that this will only require from 3 to 6 yards of your gravel surfacing per 100 feet and while it may be at a considerable distance from the improvement, it will not add materially to the cost.

Your surfacing upon such a type of road will require practically 2000 yards per mile and if the material is from different banks along the roads your cost will not exceed twenty cents per yard. It is then perfectly feasible over this section to build such a highway, including the raising of the grade from 1 to 2 feet at a cost of not more than your estimated limit of \$2500 per mile.

On section two, as I have imagined it, you have a problem of grading, rather than of drainage. That is, the soil will readily dispose of your water, but you must reduce the grades to a reasonable gradient and with a sandy material provide some method for compacting the road. The first to consider then is what shall be your maximum grade.

I confess that in this class of construction I proceed backwards, like a crab, rather than attempting to dictate an absolute gradient. That is, I take the heaviest grade and see to which per cent I can reduce this with a reasonable amount of money, instead of saying arbitrarily that a 4 per cent grade is the maximum, I figure how much it will cost for a 4 per cent, how much less for a 5 per cent and what the saving would be, should I allow it at even a 6 per cent grade.

We will say that I have found that I may reasonably reduce the grade on this section to 5 per cent. This I establish as a maximum and the other grades are brought to this maximum.

There will doubtless be considerable blasting on the large boulders to do on this section in order to properly widen your road, because the ordinary country road has no established width. In cutting your grades you will usually find that a considerable portion of the material which you have excavated in reducing the grade makes good surface material and almost your entire expense will be the shaping of your roadway and your drainage.

As I have imagined it, however, as you approach the end of this section you have run through your gravel and into what is practically sand. Here the gravel that you have on the other end will not properly compact or pack so as to make a suitable road surface and you will have to build practically a sand-clay road. I have not had good success with the sand-clay roads, unless I have practically telfordized the same by making the sub-base largely of metal.

In my treatment of this particular part of section two, I should endeavor from the gravel pits used on the first part of it to obtain the small boulders sufficient to build the entire bottom of the road to at least 6 inches in thickness of such pebbles.

These I should fill with sand up to the top of the metal, then put on at least three alternating sections of clay and sand repeating until I had my road at least 10 inches thick, harrow each section as it is built up, seeing that the top surface is of sand rather than of clay.

This portion of the section, as I advise building, will doubtless cost much more than the sum per mile than you have expended upon the gravel portion, but together they should leave your general average within the limit.

Section three, consisting largely of grade, is almost entirely a drainage proposition and it will be very necessary to practically tap the water coming from the side hill near the surface or originating within the road. You may find it necessary in many instances to run short drains for the express purpose of tapping the water holes, which come up in the road bed proper and it will doubtless be necessary on the inside of such a road to lay a side drain the entire length of every grade. A ditch should be dug on the upper side of your road to a depth of at least below frost line, a foot of sand being placed in the bottom and then an open drainage tile laid to as perfect a grade as possible and your ditch filled in with sand seems to be the most satisfactory way of cutting off this water.

Having shaped your clay road which is a comparatively easy matter as such a road will retain its section and may be practically worked with a road machine and then covered with, not to exceed 2 inches, of sand and gravel harrowed in as thoroughly as possible, though it is somewhat difficult upon a clay road to get the sand to work into it at first and the farther application during wet weather of at least 2 inches more, will ordinarily give such a road a most desirable surface. The only caution being that you must not apply the sand in large quantities at a time, but must expect to renew this surface frequently during the first two years.

We have assumed that we have now come to the ledge and boulder section and that all material must be drawn from a considerable distance to make a satisfactory road. Here without question, the most feasible plan is to use a macadam roadway. The putting up of a local crusher and the macadam method of construction may enable you to build at a less cost than would the use of the uncrushed material.

Frequently, however, on such sections there is a great difficulty in getting sufficient water to properly flush a water bound macadam road. You may obviate the use of large quantities of water by the use of bitumen but this adds greatly to the cost of your road.

Wherever macadam is used you may retain the same 21-foot section, though 15 feet should be the extreme width of the metalling. This will take 2600 tons per mile of stone and assuming the use of

2½ gallons of bitumen per square yard, your added cost will be something over \$2000 per mile. If water is fairly available, you may build your water bound road and apply one-half gallon per square yard of bitumen as a cover coat at a cost of about \$650 per mile, which will reduce the cost of your road for light traffic about \$1500 per mile. Unless there is considerable trouble about getting your water therefore I should recommend the use of water bound macadam with the blanket coat.

You must consider also the added cost of maintenance upon your macadam road as compared with the cheaper forms, so that personally I should hesitate about using macadam whenever there is a possibility of using the cheaper surfacing.

Assuming a small apportionment available for the entire mileage needing improvement the economic question is what plan will you adopt for the treatment of such a highway. Will you practically complete this 10 miles with your money or will you build 3 miles of the higher type of roadway and leave the rest unimproved. This seems to be the attitude adopted by most highway departments. They standardize their plans and specifications and are content with the small mileage of what they are willing to say is the best construction and they dislike extremely to build for small cost what they term an inferior type of road.

I believe this is a serious economic error and in most sections a road infinitely better than has previously existed may be built at a comparatively small cost to the great betterment of the roads in general and to the great help of the inhabitants of a State.

As far as automobile traffic is concerned, I am sure that many of the inferior types of road are far more satisfactory to them in general than the highest type. Your autoist cares little for a short section of the best possible road if at the end of it he plunges into what he is pleased to call an impassable road for three-quarters of the distance. I believe the development of roads in the future will be along the line of more mileage and less cost and that this is the proper trend of development.

I have talked so far almost entirely about the preliminary building of such surfaces. I want to say a little about the cost and methods of maintenance on these types of road.

Constant continuous maintenance is necessary upon all the types of roads that are built. It is indispensable, however, that upon the surfaces of the cheaper type of roadway the maintenance be both continuous and intelligent.

A road of what may be called natural surfacing, if left for even a week during the summer season without attention loses all its features of a good road. It must be constantly patrolled, all holes in it which have worn must be filled, all weak spots which develop must be repaired within a few hours after discovery or your road will so rapidly degenerate that it is useless as an "improved."

The higher types of roadway may be left for varying periods of time without attention and while this results in the end in being a more expensive method of treatment it is only a loss of money, you still have the road which may be repaired, but if you attempt this sort of treatment upon your cheap surface you eventually lose your highway entirely.

My experience is that a patrolman with a horse and cart, an efficient drag or hone and the willingness to work will keep in almost perfect condition from 5 to 7 miles a cheaply constructed roadway, at an approximate cost of from \$175 to \$200 per mile.

Given the same mileage of the higher types of road he will require a helper, a much larger equipment and if working upon bituminous roads probably not less than \$150 per mile for material in the way of bitumen, crushed stone, etc.

My average cost of maintenance upon the higher types of road including the use of a blanket treatment once in two years will not be less than \$500 per mile, and in many instances it will greatly exceed this. On the expensive road also you are constantly facing the fact that within a reasonable number of years you must resurface at a cost approximating \$6000 a mile, while upon your cheaper road, if properly patrolled, you will find that your surface material is thicker than it was at the time the road was built and has been in practically perfect condition during the entire period.

If the dust nuisance upon your cheaper road becomes intolerable it may be alleviated greatly and practically removed by the application of light bituminous oils or tars. The objection of this treatment, however, being the tendency on the part of a patrolman to allow the road to get out of section by neglecting to drag it after every rain, as he does not wish to destroy the skin coating on top, which is left after the treatment.

The cost of this treatment adds about \$150 per mile to the cost of maintenance and on the whole is not as satisfactory for light travel in its final results, as adhering to the use of the natural soil and the regular treatment by dragging.

Road problems may be roughly divided into four sub-divisions, and their order of importance is about as follows; drainage, alignment, grade and surfacing.

It is unfortunate that to most people the latter is more important, while relatively it is of far less importance than the other three. The surfacing material is frequently considered paramount and the settling of the question as to whether you have a bituminous road, penetration method or mixing, a concrete road, or a pavement type is the main subject of discussion and with far more attention given to it, than in my opinion it rightly deserves.

Your drainage, alignment and your change of grade are permanent features. The surfacing can never be permanent. I have sometimes wondered whether a bond issue to be paid for by posterity should ever be expended on any feature that is not permanent.

Concededly, surfacing of all kinds will require not only constant maintenance but rebuilding. With the essentials fully attended to it is surprising how the surfacing may be maintained at a comparatively small cost. I believe that it is as necessary for us to turn our attention to the economic side of the road question as to the scientific. A highway must have an economic road rental, as well as a fixed road maintenance and wherever the actual cost plus its maintenance exceeds its rental value we are wasting money in building too expensive a road. We must so adjust the scales that our costs are such as to provide a roadway for the traffic at the least possible expense.

I realize that this is a very sketchy treatment of the subject given me. It is not scientific, but it equally is not theoretic. Financial problems in a State with a very small assessment roll and a large road mileage has made it a necessity in my State.

In order to accommodate a large tourist traffic we must have reasonably good roads and we cannot afford the kinds of roadway that are being built in many of the richer States. We have met the problem, as I have outlined in a rambling way, and it is satisfactory to us. It seems to me that there are many other States which might well adopt a plan of more mileage at less cost to their great financial benefit and to the comparative satisfaction of their residents and visitors.

THE CHAIRMAN: Before taking up the discussion of this subject, I want to announce that the Resolutions Committee will meet at three o'clock today in the second floor front room of this building. I also want to announce that there will be a meeting of State highway officials and Federal highway officials in the moving picture room across the hall at three o'clock tomorrow. The discussion of this paper will be opened by Mr. Frank F. Rogers, State Highway Commissioner of Michigan.

MR. ROGERS: *Mr. President and Gentlemen:* I am almost without any underpinning here, because I had prepared to discuss the very paper that was written out so carefully by the speaker who has just preceded me, but inasmuch as he did not give you any of that paper, I am at a loss to know exactly what I am going to discuss but I have it all written out before me. Well, I don't know but I will take a little different view of the subject from that of the man who preceded me because I do not assume that the people who are before me all represent this territory around Atlanta. I have seen men on the platform from Washington and from Kansas and from New Hampshire and Pennsylvania and I assume that this subject is to an audience somewhat farther reaching than the territory that is affected by the roads about Atlanta.

I don't know much about road conditions except in Michigan

where I have been connected with the system for several years, but as Michigan is somewhat typical of the States of the Central West, I am going to give you a few of the problems that have occurred to us and if any of this becomes wearisome, I can cut it short.

The few traffic records that we have taken show that the travel over Michigan roads has a daily average ranging from something over 2000 vehicles per day down to a very few, say less than 10. Our traffic records also show, as have those taken by other States, that the volume of traffic drops off very rapidly as the distance from the market town increases and that on the main or trunk line roads, the minimum traffic is found approximately midway between the towns, or more correctly, where the effort to reach a given town meets with the least resistance.

To illustrate, the main roads entering the city of Detroit bear a traffic near the city limits ranging from 500 to 2000 vehicles per day, of which from one-half to three-fourths are motor driven.

The travel on the main roads entering the city of Lansing, a town of approximately 40,000 population, ranges from 200 to 600 vehicles daily with about the same percentage of motor vehicles. Michigan Avenue, which is the main road entering Lansing from the west and on the main line of highway towards Detroit, bears a traffic according to a count taken one-half mile from the city limits, of 600 vehicles per day. This road connects the city of Lansing with East Lansing, which is really a suburb of Lansing, and the home of the Michigan Agricultural College. One mile east of East Lansing on this same road, the traffic drops to 300 vehicles per day, and eight miles from Lansing on the same road and about one mile east of the little village of Okemos, the traffic drops to about 125 vehicles per day, which is considerably less than on any main road entering Lansing at about one mile from the city limits.

From the foregoing I am inclined to believe that roads having a traffic of less than 300 vehicles per day might consistently be considered as coming within the scope of this subject, and I wish to confine my remarks chiefly to roads of this class which have come under my observation.

In 1906 the Michigan Avenue road between Lansing and East Lansing, some two miles in length above referred to as carrying a traffic of 600 vehicles per day, was surfaced with water bound cobblestone macadam. It immediately began to ravel, especially midway between the two towns, due to the fact that it became a speedway for automobiles, as it was then the only improved road leading out of Lansing. The second year a contract was let to the

Refining Company to improve this road by incorporating a bituminous binder. The road was scarified and a rather light asphaltic oil added and re-rolled with a hope of binding the road. The oil did not prove a good binder and the road soon became rutted and uneven, so that it was even in poorer condition a few months after treatment than before. As this road was put in under a two

year guarantee, the next year the company scalped off the old bituminous surface with a thin layer of stone which adhered to it, and carted it all away. The road was then scarified and more bituminous material with greater cementing qualities added, after which the road was surfaced with about an inch of screened gravel and rolled. This seemed like a fairly good road for a few months, but the binder was sticky in warm weather and while the road appeared smooth, the adhesion of iron tired vehicles to the road surface made traction heavy rather than light. Later this road became very much rutted and was in poor condition and during the fall of 1913 it was decided to give the road a screened gravel top.

The bottom layer of gravel about four inches thick, loose measure, was applied to the road in the fall of 1913 and allowed to work down under traffic during the winter and spring months. In the spring of 1914 another layer of screened gravel was added which was harrowed and rolled, but mainly compacted under traffic. After the road had become fairly hard, it was treated with two or three applications of gluterin. The road surface remained in a smooth and firm condition most of the summer, but at this writing, November, 1914, the road crust is breaking at points and for quite long distances the surface presents a series of pit holes at quite uniform distances of about one foot apart, measuring along the axis of the road.

The above facts have convinced the writer that roads having as much traffic as the above, cannot be held up with water bounded macadam nor even with the best gravel surfaces, unless they have constant repairs. It would doubtless be wise to pave such roads with cement—concrete, asphaltic concrete, or brick.

Still further analyzing the traffic on the above road and rating single horse vehicles at one-half ton, double team light vehicles at 1 ton, double team loaded vehicles at 2 tons, runabout automobiles at 1 ton, touring cars at 2 tons, and motor trucks at 4 tons, the above road was found to have 225.6 tons per yard of width per day, or counting 300 days to the year, 67,680 tons per yard of width per year.

Engineer J. A. Brodie of Liverpool, who has carefully recorded his experience with the different types of road surfaces, places the total life of water bonded macadam roads at 120,000 tons, which would indicate that this road as originally built and under the traffic it now bears should not have been expected to last even two years. But this is really a heavy traffic road and does not properly come within the limits of this discussion except for comparison.

The next road out on Michigan Avenue, between East Lansing and the village of Okemos, already referred to as having a traffic of 300 vehicles per day, has a length of two and one-half miles. The westerly mile of this stretch of road on which the traffic count was taken, was built in 1908 as a 9-foot gravel road at a cost of \$1800.

The soil composing this road is a sandy loam, sufficiently rolling for good drainage. The road grade was built 20 feet wide between gutters and the central portion of the road was surfaced with 9 feet of gravel put on in two layers, and in sufficient quantity to make 8 inches of compacted depth. Each layer was harrowed and rolled separately. The gravel was of good quality, the pebbles all being fragments of the harder rocks. The surface layer was coarse enough so that from 60 to 70 per cent would be retained on a No. 8 screen. No extra binding material was added and although the gravel was harrowed and rolled, it was mostly compacted by traffic. This road has been used without resurfacing or repairs, except in spots, and there with a poorer quality of gravel than was used in the original construction, but it has been in need of resurfacing for about two years.

The road above referred to was so good and satisfactory to the users, that the writer has been asked many times why a road like this was not built between Lansing and East Lansing instead of the macadam. Of course these parties did not realize the difference in the amount of traffic on the two roads.

The point I wish to emphasize regarding this road is that it was built of local gravels and was very low in first cost, but served the needs of the community perfectly for from three to four years with but very little expense for maintenance.

While I have no data from other sources stating how many tons of traffic such a road should carry per yard of width during its life, this road has carried according to the same rating as used above, 175 tons per yard of width per day, 52,500 per year, or during the four years in which it was in relatively good repair at small cost, 210,000 tons per yard of width, or one and three-fourths times as much traffic as Mr. Brodie figures for a water bonded macadam. Sixty-six and eight-tenths per cent of the travel on this road has been motor vehicles.

The road beyond Okemos on which the count was taken is an ordinary earth road and will not be further considered.

One other road will suffice for these illustrations. It is a 9-foot gravel road built on the Grand River Road in Farmington Township, Oakland County, in 1910. It was resurfaced on account of becoming a part of the trunk line, in the fall of 1913, although it was not in bad condition at the time of resurfacing. The traffic record shows this road to have carried 195 tons per yard of width per day, 58,500 tons per yard of width per year, or during the three years, 175,500 tons per yard of width in the three years before it was resurfaced. This again is nearly one and one-half times as much as the water bound macadam was rated at by Mr. Brodie. About three-fourths of the traffic on this road was from motor vehicles. The cost of building it was reported as \$2524 per mile.

I have not given these illustrations for the purpose of showing the superiority of gravel roads over macadam, or in fact over any

other type of road, for Michigan is using almost every kind of road building material available and is especially trying to make the best possible use of the materials near at hand. They are given, however, to show that well built gravel roads are actually standing up under a mixed traffic of farm vehicles and automobiles as well, if not better, than we could hope to expect. Further the cost of these roads where good gravels can be had within a wagon haul, is very reasonable, and since the total cost of a road to a community is its first cost plus maintenance, the total cost of these roads is not great.

To show that such roads are not exceptions, but that they actually are being built in Michigan for approximately the figures given, I am taking from a table of costs which will be printed in the forthcoming report of the Michigan State Highway Department, the average cost per mile of 9-foot gravel roads, from a number of counties representing different sections of the State. They are as follows:

Allegany County.....	\$1,643
Antrim County.....	3,942

In this county the grading cost is rather heavy and the gravel was all screened.

Barry County.....	\$1,855
Benzie County....	2,154
Calhoun County.....	1,805
Clinton County....	1,983
Eaton County.....	1,725
Genesee County.....	2,577
Gd. Traverse County.....	2,833
Hillsdale County.....	2,142
Huron County.....	1,961
Kalamazoo County.....	2,414
Oakland County.....	2,426
Roscommon County.....	2,091

The above figures are sufficient to show that quite generally over Michigan, we are building roads of a type that seems to satisfy the needs of the different communities at a cost somewhat within the \$2500 per mile limit assumed by Mr. Hooker as a fair figure to expend on roads carrying a light volume and mixed traffic. In fact, 64 per cent of all the roads which have received State aid in Michigan are of gravel. It may be argued that these 9-foot gravel roads would not serve the needs of most communities. Michigan has demonstrated to the satisfaction of her own people that they do in most cases. In making inquiries regarding the width of metal track several years ago, the writer asked a certain highway commissioner in Michigan if there were complaints of his road being too narrow, since it was completed. His answer was: "It is a good deal like this: All the time I was building the road everybody who came along said it was too narrow; after it was completed, everybody who came along said it was too short."

While Michigan is building many roads with surfaces wider than 10 feet and pays extra bounty for extra width of metal surface between 9 feet and 16 feet, the greater number of light traveled roads are still built and will continue to be built with the metal only 9 feet wide. Experience shows that where the travel is relatively small, probably less than 100 vehicles per day, the shoulders of the road soon grass over up to the edges of the metal. In other words the turning out is not frequent enough to keep the grass worn down on the shoulders beyond the edges of the 9-foot metal track.

So long as the cry is for more distance rather than for more width, it is probable that Michigan will continue to reach out and have for its slogan: "Put it on the ends rather than on the sides." It is clearly the duty of the road engineer to make every dollar placed in his hands for road building purposes, give the people the utmost value in actual road service. If a gravel road which serves the needs of the community can be built for \$2000 a mile and can be maintained, including periodic resurfacing at a cost of \$200 per mile a year, thus representing to the community a perpetual annual rental cost of \$300 a mile, money being worth 5 per cent, it would seem to be folly to build the more expensive road unless traffic or soil conditions demand it. If we expend \$10,000 a mile on a road, even if there were no maintenance charge, the annual rental cost of such road will be \$500 per mile. But the expensive roads do come to repairs sooner or later and these repairs are likely to be at about the same ration as was found in the original cost of the two roads—1 to 5.

If the daily traffic over these roads is 100 vehicles a day, the perpetual toll cost of the cheaper road will be one cent per mile, while on the more expensive road it will be $1\frac{1}{2}$ cents per mile, plus the maintenance charge, which will make a toll charge much more than double that on the cheaper road, the volume of traffic remaining the same.

But as already said, Michigan is not tied to any one type of construction. This is clearly shown by the different classes of roads already built. At the close of the last fiscal year, June 30, 1914, there had been completed 2437 miles of State rewarded roads in Michigan representing the following classes: $52\frac{1}{2}$ miles of sand-clay or thin gravel roads; $1,570\frac{1}{2}$ miles of standard gravel roads; 77 miles of macadam base and gravel top roads; 23 miles of gravel base and macadam top roads; $647\frac{1}{2}$ miles of macadam roads, mostly plain and water bonded; and 67 miles of concrete roads. It will be noted that most of these roads are suited only to light volume traffic and when it is considered that the average cost of all classes is not far from \$3000 a mile, it must be admitted that Michigan is not in danger of the re-action against the high priced road mentioned in Mr. Hooker's paper.

November 11, 2 p.m.

MR. JAMES H. MACDONALD IN THE CHAIR.

THE CHAIRMAN: The convention will please come to order. I want to make a little apology for sounding the gavel 26 minutes past two, when the meeting was supposed to be called to order at 2 o'clock, but the fact is there was no one here just promptly at 2 o'clock; we have grown into the habit of being just a little tardy and while the machinery is helpful in the highest degree in road building, in my judgment these sessions are more important than the machinery end of them. I find myself, ladies and gentlemen, somewhat embarrassed; I had expected to deliver a talk on the past and present and future, in other words, yesterday, today and tomorrow in road building, but I had not learned that I was to preside over the session. So it rather embarrasses me, having sat sometimes in my little life at a banquet where I was a speaker and having the toastmaster introduce the next speaker at length and then interlard or extend his remarks; that was a very uncomfortable place. At the same time I feel that in justice to the delightful hospitality which has been extended to us here, that I ought to say something in appreciation. To me this is a singularly pleasant opportunity to be here in Atlanta. Forty years ago my little wife and I made a visit here and as we looked the situation over, the streets and the air of inactivity on every side with practically only three streets that made any pretention to being streets, Decatur, Marietta and Peachtree Streets; I come back here after 40 years and I see the little people of 15,000 have grown to a multitude, 200,000; I find the little hamlet of houses have been supplanted and been added to, not only the delightful homes of the people but the magnificent structures on every side. I have travelled at home and abroad in this great work. I have never seen anything to equal the growth that is so manifest as it is to me here in this city of Atlanta. The delightful hospitality extended to the wife and myself will always remain as a pleasant memory to both of us. So it is a great delight to come back here and to go through the scenes which are so vividly impressed on our minds as the sweetest part of our lifetime, the early memories, and live over again those days. I am happy to say we have with us today President Harrison of the Southern Railway Company. He is acceptably filling the position occupied by Mr. Finley, he is on the Executive Committee of this great Association. He has been an ardent good roads man for many, many years. The great question of transportation appeals to him very closely and we are glad to have him with us today. He is destined to be, if I may prophesy from the point of view of intimate personal knowledge, one of the greatest railroad authorities we have in this country, and this convention is highly honored when we have such a man as President Harrison to speak to us on this great question today. I take great pleasure of introducing President Fairfax Harrison.

SELECTING ROADS TO BE IMPROVED

BY FAIRFAX HARRISON

President, Southern Railway Company

In the early days of the good roads movement, a meeting such as this in the South would properly have devoted its time largely to emphasizing the advantages of good roads, but, while educational campaigns to teach the value of good roads are no longer needed in the South, the holding of the American Road Congress in Atlanta will tend to stimulate the good roads movement in all of the southern States. As soon as the present business depression, growing out of the effect of the European war on the market for cotton, has passed away, as it surely will, and when the onward progress of the South has been resumed, one of the ways in which it will be manifested will be in greater activity in road building.

When road improvement is taken up in any community, it is important that it be started right, and I shall venture to speak to you briefly on what, I think, is one of the most important matters that must be decided before actual work can be commenced. That is: the selection of the roads to be improved.

It is almost invariably true that the community embarking on a policy of highway improvement is not financially able to rebuild all of its roads at one time. Those in charge of its road policy must decide which of the roads shall be improved at once and which shall be left for the future. The answer must be found in the peculiar needs of each community.

There is a glamour about the mere suggestion of a great through highway traversing several States, connecting widely separated cities, and traveled by tourists from distant parts of the country. The very history of such roads is fascinating, as, for example, that of the Cumberland road or the national highway which pierced the West in the early days of the nineteenth century. Under modern conditions such a road may benefit the owners of touring cars, and its use by them may scatter some few dollars in the different communities which it traverses, but it will benefit relatively few farmers—only those who live along its line. In a community where the principal industry is conducting hotels for tourists, the improvement of roads with special reference to attracting automobile travel may be desirable, but, generally speaking, I doubt whether the best use that can be made of a limited road fund will be in the construction of a through highway of this kind.

The statesman of road building must consider what permanent value the road may serve in developing a country, and under our conditions in the South this consideration points inevitably to the farmer as the class most to be considered in road planning.

A good country highway is helpful, directly or indirectly, to all those who live in town as well as those who live in the country,

but it is primarily beneficial to the farmer. It is his highway to market. He and his family must use it in all of the social intercourse of the neighborhood and in church and school attendance. It is over the country road that the rural mail carrier brings to the farmer his letters and the newspapers which keep him in touch with the events of the world. While it is not generally appreciated, because few farmers keep books in which they take account of their own time and that of their teams as well as of their hired men, statistics prepared by the United States Department of Agriculture show that the cost of hauling farm products to a shipping station is a very large percentage of the total cost of their carriage to their final markets and is out of all proportion to the charges made for their transportation by rail or water. An improved road reduces this cost and has the effect of bringing outlying farms nearer to the shipping point by reducing the time required for hauling, and it tends to advance the value of each farm that it passes.

On account of the great interest of the farmer in good roads, I believe that those responsible for the road policy of any community should endeavor to expend such funds as may be available so that the largest possible number of farmers may be benefited and that this may be accomplished by improving first the roads that radiate from a market town or shipping station.

If the amount of money available is quite small, it may be necessary to limit expenditures, for a time, to a single road, but where sufficient money can be obtained, the benefits will be more widely distributed if the money can be expended on several, or all, of the important roads radiating from the town. While it is possible that, on a given road, the greatest benefits will be obtained by spending the money that may be available for it in improving some particularly bad part of the road at a distance from the town, the general policy, I believe, should be the improvement, first, of that part of the road leading out from the town. If the policy of dividing the money available among several roads rather than concentrating it on a single road shall be adopted, it may not be practicable to improve an extended mileage on any one of the roads. This will, however, permit the largest number of people to share in the benefits, for the farmer driving into town from any direction, even though he may live beyond the end of the good road, will have an improved highway for at least part of his haul to town. Then, as additional funds become available, from year to year, each of these roads may be extended further into the country, until, in time, they form connections with similar radiating roads constructed by other communities, and the entire locality is provided with a network of good roads.

While a system of radiating roads of this kind will benefit the farmer primarily, it will also be helpful to the town. In an agricultural community, without substantial manufacturing enterprises, the town is practically supported by the trade of the farmers of

the surrounding country. A good road, to the degree that it may enable a farmer to market to better advantage, increases his purchasing power to the benefit of the merchants in the town where he may trade. Improved highways radiating from a town widen the area from within which the farmer may profitably market his products and buy his supplies in the town. Good roads in any community are also an important factor in attracting farm settlers, who will bring increased trade to the town.

But we have in the South many purely industrial towns and cities which may seem not to depend largely on any back country—towns in which the trade of the surrounding farmers is relatively of little importance in the total volume of their business. Such towns are nevertheless interested in developing systems of radiating roads such as I have suggested. Even in the largest city, a certain element of the population is concerned, directly or indirectly, in the trade of the surrounding country and every resident is almost as much interested in building up nearby sources of cheap and fresh supplies for his produce market as he is in the maintenance of good schools. With bad roads that are almost impassable during certain seasons of the year the area within which milk, and perishable articles generally, can be successfully produced for the city market, is restricted. With improved roads this area is greatly extended. A system of good roads out of a city may mean, for a large part of the population, the difference between fresh food and the cold storage warehouse.

I may emphasize the point I am endeavoring to make by citing the concrete example of Mecklenberg County, North Carolina. That county was one of the first in the State systematically to take up the matter of road improvement. The United States census reports show that in the twenty years from 1890 to 1910, the population of Mecklenberg County increased 57 per cent, as compared with an increase of but 36 per cent for the State of North Carolina as a whole, and the population of Charlotte, the county seat, increased, in the same period, 194 per cent, a more rapid rate of growth than was shown by any other incorporated place of relatively the same size in the State. The value of all farm property in Mecklenberg County in 1910, as reported by the Census Bureau, was greater than in any other county in the State with the exception of but one county with one and three-fourth times the area of Mecklenberg County, and the value of farm lands, per acre, was greater than in any other county in the State with a single exception. Other factors have contributed to the progress of Mecklenberg County, but we may fairly attribute part of its growth in population and wealth to its enlightened road policy.

Other southern counties might be cited showing similar progress following the construction of improved country highways radiating from a central market town, and I believe that, wherever this policy may be adopted, its wisdom will be demonstrated by results.

A MEMBER: We have with us this afternoon another president of a great railroad system who has taken a great deal of interest in good roads all over the country; I refer to the President of the Nashville, Chattanooga and St. Louis Railway. This gentleman is known and loved and trusted by the people of the South and I feel sure we will be glad to have a few words from Mr. John Howe Peyton, President of the Nashville, Chattanooga and St. Louis Railway.

MR. PEYTON: I feel that this is an imposition because it is breaking into the program of the afternoon, and I will have to ask to be excused. I would like to express my hearty and sincere sympathy with the work that you are promoting and my desire to assist in pushing it forward. I feel that I would be imposing on your good nature to further interrupt the program.

THE CHAIRMAN: No, I think not; come right up and we will be glad to hear you.

MR. PEYTON: *Mr. Chairman and Gentlemen:* I must repeat what I have just said from the floor, I am afraid I am imposing upon you in thus breaking in on an admirably arranged program.

Since, however, you have been so good as to insist on my expressing my views as to the work you have in hand, I am glad to take advantage of the opportunity.

My enthusiastic and most worthy friend, Mr. Meyer, of Carthage, Tennessee, is doing splendid work in his State as a leader in moulding a public sentiment favorable to the construction and maintenance of good highways in Tennessee. I am heartily in sympathy with him and shall try to hold up his hands and assist him in such efforts.

Mr. Harrison, who has just preceded me, and has read a most able paper in your hearing, modestly states that he is not an engineer or constructor and therefore not in position to discuss details of good roads either as to construction or maintenance. You may be interested to know that before I became president of the Nashville, Chattanooga and St. Louis Railway I had been, for thirty-two years, in the active practice of civil engineering.

I am therefore not only deeply interested in the matters that you have met here to discuss but fairly well equipped to assist you.

I am persuaded that the agricultural interests of our country are paramount in importance, but that successful and progressive agricultural development is not possible without adequate provision for transportation by means of good highways from the farms to the railroads and good and efficiently managed railroads leading thence to the markets.

Being thus persuaded, and being devoted to my country, I am doing all in my power to promote scientific agriculture; good highway construction and maintenance, and good railroad construction and operation.

I came here seeking information that may make me more efficient in furthering the highway projects in my State.

I thank you heartily for giving me this opportunity to look you in the face and now I am going to listen most attentively to the papers that are to be read by the gentlemen whom you have selected as most competent to instruct us.

THE CHAIRMAN: There are many questions that come up for our consideration in road building, but there are no questions that have come up to disturb the commissioners more than to take care of this great question of the heavy traffic roads. Of course we know that the macadam road will wear out and the gravel road will wear out, the brick road will wear out and indeed the great presidents of these railroads will tell you that they have never been able to put that little piece of rail down yet but what they had to be replaced. I have sometimes thought that there is nothing in this world but what will wear out except perhaps it might be the mercy of God, and that is sometimes severely tried. One of our citizens happened to go through Maryland, and we are pretty proud of our roads up in Connecticut and think pretty well of them and I want to tell you that it is not with any feeling of envy or jealousy that I relate to this convention what he said to me, for I served Connecticut 18 years as commissioner. He said, "Mr. MacDonald, I never rode over better roads since I have been on that car, and it has been a good many years, than I rode over in Maryland." We have with us today a gentleman who assisted materially in bringing about that condition of affairs, Mr. Henry G. Shirley, and I take great pleasure in introducing him.

HEAVY TRAFFIC ROADS

BY HENRY G. SHIRLEY

Chief Engineer, State Roads Commission of Maryland

The rapid change that has taken place, and which is daily taking place in the character of traffic on our highways, makes the selection of the type of surface more difficult each day for the highway engineer. In selecting a type of surfacing for any particular road, the engineer not only has to study the amount and kind of traffic that daily passes over the road, but has to make a very comprehensive study of the amount and kind of traffic that will probably pass over the road in the future, by virtue of the development of the surrounding territory on account of the improved road.

The writer has made studies of roads where the traffic, before improvement, consisted of light vehicles and nothing heavier than two-horse loads, but as soon as the road was reconstructed, the amount of traffic increased from 50 to 300 per cent, and the loads from light two-ton loads to ten to twelve-ton motor trucks, and

fourteen to eighteen-ton tractors. He also recalls constructing a section of road through a very sparsely settled section, and estimating that it would be quite a long time before the adjacent territory would be more thickly populated, and accordingly selected a soft local limestone for the metal surfacing, but which had sufficient strength and hardness to carry the traffic that was passing over the road at that time. Scarcely had the road been completed when several large tracts of woodland, not a great distance from the road, were cut down, and the lumber was transported on wagons, drawn by large traction engines with cleats, over the road to the railroad station. The effect of this heavy traffic on the soft limestone surface can be easily surmised.

Drainage of a road-bed that is required to carry heavy traffic, should be well taken care of by tile or other sub-surface drains, so as to render the sub-foundation as dry and firm as possible. The maximum grade should not exceed a 6 per cent, and the alignment should be as straight as possible, with all sharp curves and bends eliminated. The width of the roadway and the width and thickness of the metal surfacing should be designed to meet the requirements of the present as well as the future traffic which it will have to accommodate, but the minimum width should not be less than 30 feet, nor the metal surfacing less than 18 feet. Broken stone or gravel make a fair foundation, but concrete is almost as cheap and is more preferable.

The thickness of macadam and gravel should not be less than 5 inches after rolling, nor more than 10 inches, while concrete should not be less than 4 inches, nor more than 8 inches, depending primarily, upon the character of the soil of the sub-base, and the intensity and character of traffic it will have to sustain. In some cases where the loads are very heavy, but the number of loads small, it has been found economical to lay a strip of high-class and durable pavement in the middle of the road for a width of 9 to 14 feet, with a cheaper and less durable material on each side.

Before selecting the type of pavement to be used, a close and accurate census of the different kinds of traffic should be taken, a very thorough study made of the surrounding section, and an estimate made as to the possible increase of the different kinds of traffic, or the decrease of one kind and the large increase of the other. It is the opinion of the writer that in no other line of engineering should there be a larger factor of safety used than in estimating the amount, intensity, and kind of motor and self-propelled traffic that will pass over our improved roads in the near future. The great change in the character of traffic developed in the past five years, is but a small index to what can be expected in the next five years to come.

The types of pavements used on heavy traffic roads should be selected as to their fitness to stand the kind and intensity of the traffic that will travel them. Roads in the outlying districts, where horse-drawn traffic comprises the larger percentage should be constructed of macadam with a light surface treatment. Concrete will

also be found serviceable and desirable. Where motor traffic is in the majority, bituminous macadam or concrete will give good results. Near the centers of population, where the traffic is mixed and heavy, concrete, bituminous concrete, asphalt or vitrified brick will prove the most economical. Where the heavy traffic is concentrated, brick, asphalt or stone block are the most suitable.

There can be given no hard and set rule for selecting the type of construction that should be used on a given section of road to carry a known traffic. For local conditions, the availability of materials, etc., play such an important part in the selection of the type of surfacing in any locality, that each individual case must be worked out on its own merits.

The following method of selecting a type of surfacing to carry an estimated traffic, however, will prove fairly accurate where a study can be made and the maintenance cost can be had of roads constructed and maintained under similar conditions:

Where the annual cost of maintenance of a less durable type of road surfacing will exceed the annual cost of maintenance of a more durable type of surfacing, plus 4 per cent on the excess cost of the more durable type over the less durable type, the more durable type should be used, and vice versa.

The maintenance on heavy traffic roads should be continuous and thorough—never allowing the surface to remain broken any length of time, but as soon as the slightest defect or indication of failure appears, it should be speedily repaired.

The writer cannot close this paper on "Heavy Traffic Roads" without calling the attention of the Congress to the great necessity for having adequate laws to regulate the heavy loads that have to be borne by the surface of the many hundreds of miles of roads that have been and are daily being constructed. The manufacturers of tractors, motor trucks, and other hauling engines, have given but little study to the effect and injury that is being done and may be done by the heavy loads propelled over the road surface, and the strain and stress caused by narrow tires, steel cleats, ribs, and other devices, but it seems that the greater amount of their energies have been to develop an engine or motor truck that will haul the largest load in the shortest period of time, using the least amount of fuel—all of which is very commendable, but it is the duty, as well as to the welfare of these manufacturers, to devote quite as much energy and brains in constructing their engines and motor trucks in such a way that the least amount of damage will be done to the surfacing in passing over the roads. It is most important that the manufacturers of hauling equipment and highway engines should work together in framing a set of adequate laws controlling the use of hauling equipment over improved roads, as well as developing wheels and other devices so as to do the road surfacing the least amount of damage. By coöperating and working together, large sums can be annually saved on maintenance, which will greatly benefit all concerned.

THE CHAIRMAN: I think that if the title of this address had been changed to read "What is the Best Material to Use Upon Heavy Traffic Roads," that quite a number of gentlemen who are out here selling material would have been in the hall and would have filled it up. I remember one time hearing a man say that if people would buy one of his grates they would save half the coal, if they bought two they would save all the coal and if they bought three of his grates they would have coal to sell. We are going to have this discussion opened by a gentleman who is Superintendent of Public Works of Fulton County, Georgia, Mr. William A. Hansel, Jr. Those of us who have been privileged to go out here in Fulton County and see the splendid system of roads that he has developed and know that this has all taken place within the last 15 years—I want to tell you it has been a stupendous operation, and under the condition which he had to contend with, this red mud of Georgia, he has solved a difficult problem. He has built the roads not only where the people live but where the people are going to live in these little isolated places, and it is a pretty good lesson for all of us commissioners who have had to do with this great question for so many years. I take pleasure in introducing Mr. Hansel.

MR. HANSEL: It is but just to my predecessor in office to state that the good words the chairman has spoken about our roads are not due to me; I have only been with the county a few months, while my predecessor has been with the county 27 years and most of the good work is his and not mine. However, I hope to continue the work he has started. Mr. Shirley has so covered the subject that I shall have no opportunity to bring out new points but I would like to particularly emphasize some parts of his paper. The first thing is, of course, to make as thorough a study of the traffic conditions as is possible, with a comprehensive investigation as to the materials locally available and the ability of local labor to use these materials. After this has been done the road selected must be the one that best serves its purpose and whose cost stays within the money appropriated for its construction. Quite frequently we are obliged to put down what we know is not best, because the money for the proper construction is not available. It is sometimes possible to get a good road by putting a narrow strip of expensive material in the center and paving with less expensive material on the sides. It is much better to have 12 feet of good road and a cheap gutter than a cheap road the full width. A rubble side pavement costs very little and if given a finish of cement grout makes a very good substitute for an expensive road. You can see this being put in on the concrete road now under construction here. A plain macadam road is a fairly good road and if given a surface treatment of road oil or some similar coating it is much improved. If the road indicated is macadam it does not cost much more to make a penetration bituminous macadam or a concrete road and either

is much better. If you have more money to spend, a mixed method bituminous macadam is still better or using a concrete base, asphalt, brick, wood block or granite block. Where the money to be invested is little, heavy traffic can be cared for by sand-clay and top soil roads if the maintenance is continuous. Where a pavement laid on a concrete base is indicated, it would usually be cheaper to make the entire pavement of concrete and with the present rich mixtures very satisfactory results are obtained. Whatever the road, it is very necessary, after taking care of drainage, to see that all ditches are properly refilled and tamped from the bottom up. Too frequently an otherwise splendid job is marred by the sinking in of a ditch and the accompanying bad place in the pavement. It costs little to fix the subgrade properly and bring a rich reward in the permanence of the job. The foundation of the roadway should not be too thin or if of concrete, too lean. However perfect the studies made, the conclusions reached as to type of pavement, the specifications, the material contracted for and the intentions of all parties concerned there will not be a good road without proper and continuous inspection. Too often an inspector is appointed because he can control so many votes or because he is a jolly good fellow or because he needs the job rather than because he is competent. Hasten the day when an inspector is appointed solely because he knows his business and will attend to it. After your proper type of road is properly constructed comes the trying time. If a top soil or sand clay road, keep it dragged; if macadam, keep the little places stopped; if surface treated, patch the little bare places; if bituminous macadam, cut out the little breaks and refill them and so on down the line but never lose sight of the three rules for good roads, (1) maintain them, (2) maintain them, (3) maintain them. Some of our roadways because of lack of maintenance make me think of George Washington Johnson, colored, the leader of a church choir. His rector went to Boston to get money to build a new Episcopal Church and was much taken with the "High Church" forms he saw there, particularly the use of the burning incense carried in the processional. He determined to try it at home and rigged up a tin can with some brass chain of limited length so that it kept the can rather near the hand of the bearer. The choir was duly trained, and G. W. J. chosen the bearer of the wondrous innovation. At the first public appearance the church was packed and the rector led his forces down the center aisle in great glory. When he reached the altar and turned to face the procession his astonishment was unbounded on noting the absence of the incense vessel. He was too game to show his surprise openly, but intoned, "What have you done with the incense pot?" G. W. J. was equally game and answered, "Dropped it on the floor it was so blamed hot." Maintenance is "hot stuff" but let us grit our teeth and do it rather than letting our roads go to pieces.

THE CHAIRMAN: We will continue the discussion on this great question by asking Mr. Charles Warner, of Wilmington, Delaware, to give us a few remarks.

MR. WARNER: As a sincere friend and firm believer in concrete for road construction, I present this paper touching on its deficiencies and lines of correction. Most engineers and contractors have overlooked important principles in handling concrete for this purpose. H. Purvis Taylor, Richard K. Meade, Sanford E. Thompson, E. W. Lazell, Ira H. Woolson, Henry S. Spackman, American Society for Testing Materials, Government Bureau of Standards and other prominent engineers and societies have called attention to the following important principles and the best methods of making concrete meet these desirable points:

First: Homogeneity and plasticity with a minimum of segregation while mixing and placing.

Second: Elimination of shrinkage during the preliminary hardening period.

Third: Minimizing porosity and permeability to moisture after hardening.

Fourth: Minimizing expansion and contraction due to moisture changes. The intermittent stresses produced in the relatively thin slabs employed in concrete roads by the pressure of heavy wheels and by the exposure to the weather make the full recognition of the above principles of the most vital importance.

This paper will summarize the conclusions of the above prominent engineers and societies on the effect of hydrated lime in concrete mixtures as bearing on these principles. Hydrated lime, now regularly manufactured by over 80 plants in the United States, is a soft, dry, bulky material. Portland cement is comparatively coarse, sandy, heavy and dense. When mixed with sand, stone and water, there is a marked tendency to segregation of the cement. The wetter mixes of concrete used to facilitate its placing aggravate this condition. "Stone pockets" are commonly observed in inspection of concrete work. The reason is evident on watching the flow of concrete upon placing. The direct effect of hydrate additions is to make a fat unctuous concrete, which will flow better and segregate less in transmission.

Spackman said in a recent address before an engineering society: "Durability of concrete is dependent more on uniform distribution of the cement through the mass than on the actual quantity of cement in the concrete."

Edwards, of Edwards and Lazell, engineers, Portland, Oregon, in a recent pamphlet said: "The properties of plasticity and homogeneity which small percentages of hydrated lime give to concrete cannot be secured in any other way at so little added expense for the material used."

For these reasons several of these engineers claim that hydrated

lime is an insurance against poor workmanship and conveying methods which cause segregation.

The question of shrinkage during preliminary setting has been tested extensively by the Spackman laboratories of Philadelphia during the past two years. Spackman has proven that the ordinary concrete used under the usual road conditions shows marked shrinkage the first 24 hours before hardening. Spackman further reports that the best methods of protecting the top of the fresh concrete only partially offset seepage of the gauging water through the sub-base. This seepage naturally produces shrinkage and develops incipient fractures which later become cracks and lines of weakness.

In test slabs of concrete with hydrate additions made coincidentally, the result during this tender age was decidedly different. In *Concrete Cement Age*, March, 1914, Spackman states that, "with the draining off of the excess gauging water, there is a marked shrinkage in the 24-hour period" and later adds: "The addition of hydrated lime. . . . markedly reduces the shrinkage due to draining off of the surplus gauging water and also reduces the extent of the movement of the test pieces when alternately wet and dry," etc.

The direct effect of permanent waterproofing of concrete slabs by the use of hydrated lime additions was discussed thoroughly in a series of pamphlets and articles issued by Lazell several years ago. Lazell first analyzes various waterproofing methods and concludes that the introduction of some foreign material or materials into the mixture is the best principle to work upon. He then analyzes the characteristics of such a material, stating that:

A material to fully meet the requirements should have a mineral base and should be composed chiefly of lime so as to be similar to cement in its chemical composition. It would therefore seem that hydrated lime would be a material that would most nearly fill the requirements. Clay has been suggested as a suitable material but its use in practice would be impractical owing to the tendency of its particles to adhere, forming balls. These balls have little adhesion and hence would injure the strength of the concrete.

Quoting again from a report of Committee D-8 on waterproofing materials of the American Society for Testing Materials:

In general, more desirable results are obtainable from inert compounds acting mechanically, than from active compounds whose efficiency depends on change of form through chemical action after addition to concrete;

Void-filling substances are more to be relied upon than those whose value depends on repellant action. Assuming average quality in sizing of the aggregates and reasonably good workmanship in the mixing and placing of the concretes, the addition of 10 to 20 per cent of very finely divided void-filling mineral substances may be expected to result in the production of concrete which under ordinary conditions of exposure will be found impermeable, provided the work joints are properly bonded, and cracks do not develop on drying or through change in volume due to atmospheric changes, or by settlement.

On the point of endeavoring to secure this result by richer cement mixtures in the concrete, this same report says:

It has been suggested that impermeable concretes could be assured by using mixtures considerably richer in cement. While such practice would probably result in an immediate impermeable concrete, it is believed by many that the advantage is only temporary, as richer concretes are more subject to check cracking and are less constant in volume under changes of conditions of temperature, moisture, etc. Therefore, the use of more cement in mass concrete would cause increased cracking, unless some means of controlling the expansion and contraction be discovered.

The Bureau of Standards at Washington in its exhaustive report on waterproofing cement mortar states:

This is the most efficient medium and results in an almost impermeable mortar at the two weeks' test. Its value is probably due to its void filling properties and the same results could be expected from any other finely ground inert material, such as sand, clay, etc.

The word "this" refers to hydrated lime used in these tests.

While from the standpoint of producing a waterproof concrete, the various substances mentioned other than hydrated lime might prove equally effective, their use as a substitute for hydrated lime would not give the same plasticity to the mortars or concretes. It would seem dangerous in view of the well known bad effect on the strength of concrete, of silt, fine sand and clay matter in the sand, to add such material to concrete roads, whereas in adding hydrated lime, a material is used that is mildly cementitious in itself, has a different physical action and no risk should be assumed.

Spackman in a recent address before an engineering society in Baltimore stated:

The greater plasticity and readiness to flow into place observed in the use of hydrated lime in concretes is probably a void-preventative and therefore aids in completing the void-filling action noticeable by the use of small proportions of hydrated lime.

Both Taylor and Thompson during the past eight years have exhaustively tested this vital principle of waterproofing concrete so particularly essential in road construction. In their reports made at different times to the American Society for Testing Materials, they show most conclusively the large improvement coming from small additions of hydrated lime in producing practically waterproof results.

One run of tests by Thompson illustrates: A 1-3-5 concrete under water pressure of 60 pounds to the square inch had its flow per hour reduced from 70.6 down to 0.7 grams by the addition of 20 per cent of hydrated lime. In this important series of tests, Thompson brings out the point also observed by Spackman and other engineers that:

The cost of large waterproof concrete structures frequently may be reduced by employing leaner proportions of concrete with hydrated lime mixtures, and small structures, such as tanks, may be made more watertight.

This observation leads to the special problem of leanness in concrete mixtures and its resultant economy. As referred to above in the report of Committee D-8 of the American Society for Testing Materials, and as generally known, the richer a cement mixture, the greater the expansion and contraction under moisture changes. Spackman illustrates this by observing that neat cement moves approximately four times that of a 1-3-5 concrete and that a 1-2 cement mortar will move approximately 50 per cent more than 1-3 cement mortar under the same moisture changes.

A neat cement mixture would move upwards of 4 inches in 100 feet between extreme dry and wet conditions. The effect of movement of this kind in road slabs is evident and the importance of reducing such movement to the absolute minimum for the purpose of permanency goes without saying. Therefore, the use of the leanest concrete mixtures consistent with the desired strength becomes good practice, both for economy and permanency of construction.

This leads to the question of toughness and strength as affected by hydrate additions. The extended tests made by many of these engineers justify the following general conclusions:

First: By substituting 10 per cent of hydrated lime for 10 per cent of cement slightly lesser strengths are noted but the variations are immaterial as compared with variations due to other factors in concrete work.

Second: By the addition of 10 per cent of hydrated lime to the cement ingredient slightly greater strengths are secured. (These substitutions and additions are by weight.

Spackman further made tests on toughness or, more properly, wearing characteristics, by tumbler. The concrete with hydrated lime addition lost 0.6 per cent by weight as against a loss of 1.5 per cent by the corresponding sample of straight concrete under similar conditions. Spackman attributes the improvement to the greater homogeneity and uniformity naturally resulting in the sample using the hydrated addition.

In conclusion, I wish to point out the following:

First: That hydrated lime is now manufactured by many plants under the same strict chemical control as used in the best cement mills and so far as care in its manufacture is concerned, is as safe a material to use as Portland cement.

Second: The American Society for Testing Materials has recognized the position of this material and is standardizing it. Tentative specifications have already been adopted as a guide for the use of engineers to assure a sound and reliable hydrated lime.

Third: Hydrated lime and Portland cement are neutral and there are no unknown or uncertain chemical actions to set up. Therefore, there need be no fear or concern of any uncertain chemical or physical action in the use of hydrated lime in any concrete or cement mortar work.

Fourth: Short stretches of concrete, say 100 feet or thereabouts

will not demonstrate the average improved results in the use of hydrated lime. If it is agreed that the principles set forth in this paper are sound, then relatively large sections of permanent roads under construction, say 500 to 1000 feet, should be subjected to hydrated lime addition and the average result of these hydrated sections should be compared with the result of several miles of straight concrete sections constructed under the same general average conditions.

For these various reasons, I therefore urge as most important the study and practical development of hydrated lime in concrete for all road work. If the conclusions drawn from extensive work and study of the prominent engineers referred to mean anything, they mean that much better concrete results from the judicious use of hydrated lime.

With these deficiencies covered in a practical manner, we have in concrete a road material of great value.

THE CHAIRMAN: The discussion will be continued by Mr. Paul Hannagan, Mayor of the city of Lawrence, Massachusetts and also Commissioner of Engineering.

MR. HANNAGAN: I come from a section of our country where granite is plenty; where the great adamantine ribs of the earth come near the surface and crop out into giant hills and puny mountains.

We are near the highest point of land in the northeastern section of our country, Mount Washington, which towers over 6000 feet above the sea.

The great ice floe of the last continental glacial epoch of ten thousand or a hundred thousand years ago, as you may please to estimate the time, passed over the section where I make my home. It planed down the mountains and filled up the valleys.

So while we have beautifully wooded hills and smiling and fertile valleys the highest point of land is low when compared with the lofty peaks of the Rockies.

The ice floe did a good work not only in levelling things up tremendously but in scraping off the softer rocks which may have formed on top of the earlier formation, leaving vast stretches of the bare granite rock bleaching under our torrid summer's sun or subjected to great contraction stresses in our frigid New England winters.

So we naturally turn to this material, lying at our very doors, for much of our paving material. It is ideal in many ways and we think we are especially fortunate in this respect. Other sections of the country, I know, are as fortunate as we are.

I have read of the old Roman roads. Of that wonderful Appian Way, running out from imperial Rome for an unbroken stretch of 350 miles, begun more than 300 years before the Christian era. How after a lapse of nearly 1000 years it was reported to still be in perfect condition, and that even now parts of it are still in use.

It was built generally 3 feet deep of stones laid in mortar, with a wearing surface of flat stones of irregular shape carefully fitted together. An undertaking which in our day would be prohibitive on account of its expense. It was not more than 18 feet wide in its greatest width, and I think I have seen it estimated that such construction would cost some \$250,000 a mile today.

I have read too of the old Roman roads built by that great people in their conquered province of Britain. How they ran north and south, and east and west, giving access to all parts of the province for use in keeping the native people in subjugation.

In Queen Elizabeth's time these roads had been entirely neglected and many of them were impassable. In fact at that time England had no good roads. About London they were said to be fair, but sandy. In the country districts the traveller floundered through mud and tumbled over boulders. The roads were practically impassable to vehicles, in fact, none could be had for hire outside of London. Travel was almost entirely on horseback. There were few bridges and what there were were generally the gift of the church or individuals. For the most part streams had to be forded. The foot traveller, if the stream were narrow, passed over perhaps on a timber which had been felled across, and he was lucky if a hand rail had been provided for his safety.

All down through the eighteenth century there was little improvement, and it was not until MacAdam and Telford began their work that street building became in any way a science.

Every road builder is familiar with their methods, and every city in this country where any stone is to be had has miles and miles of water bound macadam. So common is it that we even spell the name with a little "m."

The natural resources of New England furnish some of the best materials for this method of construction. We have plenty of the hard rocks suitable for macadam, and until the automobile came it was in many ways the best form of construction for country roads and also for city streets of light traffic.

Large areas of Massachusetts furnish field stone in quantities. They were the foot balls, the marbles, of the great continental glacier. They have been rolled about, rubbed down and sandpapered by nature's titantic forces for ages and ages. Much that was soft has been ground into sand and dust. We have great hills of perfect mortar sand, sharp and bright. The larger part of the boulders that are left are hard and furnish a fair road material if the softer ones are carefully culled out.

The old race which first settled our section piled up these stones into walls for dividing the land. They climb over hills too barren even for a sheep pasture, and run down into valleys and swamps where the land seems hardly worth dividing up.

These walls have been a mine of modest wealth in the vicinity of every city, furnishing an easily accessible source for stone for

foundations and later for crushing, particularly for concrete. If considered too soft for a wearing surface for macadam they are at least hard enough for the foundation courses.

Under automobile traffic, macadam, in all the more heavily traveled roads, is proving unsatisfactory. It is so in my section of the country, and I think it is the general opinion everywhere.

Because of the proximity of my city to the great source, the great quarries of granite, I have turned my attention particularly to the development of granite pavements. We are told that the great items to be considered in street pavements are cost, smoothness, noiselessness, durability, sanitary conditions, maintenance, ease of traction, non-slipperiness, ease of cleaning, etc. The granite pavement as I lay it meets most of these conditions perfectly.

Originally many of our cities had cobble pavements. The city of Lawrence was fortunate in having only one street of that material, and that street disappeared so long ago that few remember we ever had one.

Granite blocks laid in the old way with sand joints became in a few years under the wear of the traffic but little better than cobbles. The joints rounded off in a surprisingly rapid way and teams bumped along making a frightful noise and producing most uncomfortable sensations to those riding.

The only way this particular character of wear can be prevented is by filling the joints with a material about as hard as the stone itself. We luckily now have a cement far superior to any which could be procured in any preceding age. So hard is it when properly mixed and used that it is almost as indestructible as the block itself.

While first cost counts to quite an extent in determining the character of a city pavement, I have noticed that it is soon forgotten if the pavement proves acceptable. It is so with all great public improvements. While granite block may perhaps approach the highest in point of first cost, it is really cheaper, in the long run, as no repairs are required. The pavement has become so universally acceptable in my city that no opposition has developed against laying it in large quantities, even to spending 25 per cent of the total city disbursement on this character of work in this present year. Where a few years ago people said they knew when they struck Lawrence by the bad condition of the roads, now they know Lawrence by coming onto streets nearly as smooth as a polished floor.

The durability of granite block can hardly be questioned, at least its durability as compared with other popular pavements. It has one peculiarity. Where most pavements begin to deteriorate immediately on their being subjected to traffic, granite block, for several years, continually improves. This may be a surprising statement, but it is absolutely true. Not only does the pavement become smoother, but less slippery.

All granite blocks are more or less uneven. We expect the irregularities will not exceed one-quarter of an inch, but even this irregu-

larity is noticeable particularly with iron tires on an ordinary wagon, and the speed of an automobile seems to accentuate them.

The cement grout, while it evens up the surface to some extent, is not intended to be left in any appreciable thickness on the pavement, so much of the original irregularity of the granite block remains when the street is first opened. But under the traffic these irregularities gradually disappear, they are ironed out in a way. So monolithic is the pavement that the hammering of heavy vehicles does not affect it in the least.

A large part of the stone we use, preferably the quality we use, is the mica granite rather than the hornblende granite. Instead of wearing glassy with a somewhat gritty surface so that the footing for horses, except under exceptional conditions of ice or slime, improves as time goes by.

In maintenance granite is superior to all pavements. The great drawback in a pavement with us is the cutting of trenches through it for various purposes. Sometimes it seems as though the pavement was hardly down before some individual discovers they must dig it up for some purpose. The objection against digging up the pavement seems to increase their desire to do it.

In a small city where we know so many by their given name, where we are almost like members of one family, it is exceedingly difficult to stop this digging up of a new pavement. In the case of a State or national highway the impersonal condition of the controlling factor makes it easy to forbid much that a government of a small city finds it hard to do. However, I can repair one of my granite pavements so that the patch can hardly be discovered, much less noticed.

Long longitudinal joints in all kinds of pavement, that is joints which from their location in the street can come under the direct line of the travel, must be avoided, for any kind of pavement will wear into ruts if wheels can travel along a joint. So if repairs are made where trenches are cut the pavement must be toothed out, no matter how hard the material or what the character of the joint filler. It makes no difference.

In ease of traction I cannot see why smooth granite pavements will not stand as good a test as any other kind. I believe tables of resistance to traction of the various road surfaces place granite some distance below the top. It seems to me that these tests must have been made on worn pavements with sand joints or at least with joints filled with an elastic yielding material. With smoother granite pavements traction resistance will decrease with the age of the pavement, while with other pavements traction resistance continually increases.

In ease of cleaning these granite pavements can hardly have a superior. They can be almost as easily swept as a hardwood floor, far more easily than a tar concrete sidewalk.

They can be flushed without the least injury, even with positive

benefit. They respond perfectly to all kinds of mechanical cleaning. In themselves they are practically dustless. Their wear is almost infinitesimal.

In the matter of noise there is less perhaps to be said in their favor. But they are less noisy than granite block having any other kind of filler and their merit is so great in every other particular that the question of noise can perhaps be put to one side for a time until the use of the auto in practically all of the municipal activities which call for transportation eliminates this question entirely, and then smooth granite pavements will be regarded as nearly ideal as anything material can be, until we pass on to the streets of gold in the Eternal City.

I lay my pavement on a sand base. Only exceptional conditions will demand a concrete foundation. The blocks are deep, from 7 to 8 inches. In width they run from $3\frac{1}{2}$ to $4\frac{1}{2}$ inches and in length up to 12 or 13 inches. We estimate they will lay about 24 to the square yard. All our contracts for blocks are by the square yard measured after laying. We excavate by contract by the cubic yard. We haul the blocks by contract by the square yard, and we lay the blocks and finish the pavement with our own help by day labor.

I have never seen a granite pavement fail because of the character of the blocks. Its very life depends on the treatment of the joints. Under my instruction and direction the men employed in doing the grouting on our Lawrence pavements have become adepts in the line. The grout is mixed one to one in special boxes by hand. Because the joint filling is so vital, and makes or breaks the pavement, I have given this particular part of the work my most careful attention and have prepared a set of specifications which in my opinion will meet all requirements.

The Massachusetts State Highway Commission were the pioneers in State road construction. They experiment with every known pavement and keep abreast and ahead of the grand procession of road builders. This season, in Lawrence, they authorized me to build the only piece of road they have in our city, with granite blocks laid in the manner described in this paper.

Within 10 years I believe the Massachusetts State Highway Commission will adopt granite block pavement for most of the State highways, and will lead the world in this method of construction.

THE CHAIRMAN: I see Brother Blair getting up to talk about bricks, but before listening to him we will have a few words from Mr. W. A. Aiken, an engineer from New York City.

MR. AIKEN: The "test of time," that of service endurance, is undoubtedly most valuable to determine the permanent effectiveness of any roadway material for constructive purposes.

Anticipating this, preliminary information can be acquired through

the application of certain accelerated mechanical tests, which from time to time have been standardized by their adoption by recognized authority and promulgated as specification tests. Several years ago the United States Department of Agriculture published a series of test results upon a number of roadway materials, among them slag. Some of the tests used in this investigation, have been formally adopted and issued as standard by the American Society for Testing Materials, upon the recommendation of Committee D-4. It should be noted, that no detailed information, within the writer's knowledge, was given at the time of publishing these test results as to the original chemical composition or method of commercial preparation of the slag reported on, though from the number of samples tested it is to be assumed they probably came from widely different sections of the country. While blast furnace slag in the same district, arising from the use of practically the same raw materials in the process whence it is derived should be comparatively uniform chemically and physically, there will be considerable variation found if comparison be instituted between this product, from different manufacturing districts and there certainly must be greater differences between slags even from the same district, prepared differently for commercial purposes. So that it must be understood that when blast furnace slag is herein referred to, material of limited chemical composition and properly handled in its storage and preparation for market is intended whether its use be for macadam, waterbound or bituminous bound, or concrete construction. The government test results above referred to, have been in a more recent publication noted as having been brought down to 1912. These reveal comparatively more or less fully the physical characteristics of the different materials examined, covering percentage of loss through abrasion, degree of hardness and toughness, tendency to absorb water, compressive or tensile strength, specific gravity and cementing value. Upon an arbitrary scale all results are measured so that within certain maximum and minimum limits, the materials are graded as low or soft, medium or fair, good or hard. It must be realized that a high rating in one characteristic, while theoretically tending to recommend the material, might practically materially impair its average value if radically influencing any other characteristics. One material might be so hard and tough as to show such slight loss in abrasion with consequent low cementing value, that its use in actual service would necessitate the addition of some extraneous binder. This of course would apply more particularly in the consideration of materials for waterbound macadam construction and not be of such moment in bituminous bound or surface treated construction. But it will be recognized that the best material for general roadway purposes, unless special conditions are to be met, is that, wherein is combined in as high a degree as possible as many of the desirable physical characteristics of the ideal material, well balanced. As the theoretically ideal roadway is of monolithic con-

struction, the distinction previously drawn, showing the importance of good cementing value in any material, however otherwise desirable, will be recognized as an important one. It is this property of one of the components of concrete, that gives great value to this material for roadway purposes.

Examination of the test records show that some slag—and mark the author's insistence on quality which can be guaranteed—meets all the test requirements with a particularly high cementing value. This was to have been anticipated since this material closely approximates in chemical composition as it does on a small scale, in mode of production, natural puzzolanic material, whose cementitious value has been utilized for thousands of years. The necessary degree of hardness of any material proposed for structural use must not be sacrificed merely on account of good cementing value, but that blast furnace slag is sufficiently hard to comply with roadway specification requirements, has been developed to the writer's complete satisfaction by a series of tests on concrete specimens, where comparison was instituted between broken stone, trap and limestone and slag used severally as coarse aggregate with identical cement and fine aggregate. These tests, showing average results for each period from 28 days at 3 month intervals up to 1 year, embodied probably the greatest number of individual specimens ever similarly investigated. These were submitted last June to the convention of the American Society for Testing Materials at Atlantic City. The specimens were 6-inch cubes of 1-2-4 concrete and the strength values obtained from the slag concrete at all periods, compared perfectly with the average values in the author's experience of similarly proportioned concrete irrespective of difference in character of the coarse aggregate. The marked porous, sponge like structure of the slag, characteristic of the output from modern furnaces and quite different from the old style glassy, hard, brittle material, aided greatly to produce a monolithic character in the concrete. The specimens upon crushing presented a markedly different appearance to those where the coarse aggregate was broken stone and this is equally noticeable where sections of macadam work are examined for fracture appearance: different materials showing very differently, that from slag on account of its porous structure and high cementing value, showing a much more monolithic type than the general run of materials.

These tests all emphasize the cementitious value of the material as a specially important factor in determining its possible selection over other materials. There are some practical advantages in the use of slag which are not developed by the above laboratory tests—which do appear when the material is put to a practical use in road building. Through sections of the country where natural drainage is poor, this very adverse circumstance tends to accentuate the value of the slag as base material. This must not be interpreted of course, to imply that where practicable, proper drainage is not

to be provided for but only to show that slag shows to advantage where other materials would naturally fail under similar use. Again, with most road materials used in the base, the necessity often exists for bringing in special top dressing. It is the experience of everyone who has used blast furnace slag for roadway construction, that the ordinary side ditch material furnishes, in combination with the slag base, a finish that, in a very short time is surprisingly satisfactory, one which withstands traffic in a manner entirely its own and with use of such side ditch material on ordinary base material, the function of the ditch material simply being to hold the slag in place until the monolithic character of the road is fully developed.

Experience, the "test of time" has generally corroborated preliminary conclusions based on mechanical tests furnishing relative values of different materials. A number of years ago, in the infancy of the awakening thought for better roads, it was authoritatively stated that nearly one-half of this country was very illy provided with materials suitable for roadway construction. Much of the extreme South was undoubtedly referred to in this statement and the appreciation of slag as better material than much locally found, is shown by its widely growing use in the Gulf States. Natural puzzolanic material, wherever available, was used by the Romans, the greatest road builders in the world and the most highly technically educated nations of modern Europe have long recognized the value of that other similar material, slag. In this country, except by management of the large iron and steel industries and by communities adjacent to their plants, little thought, except sporadically, has been given, until comparatively recent, to conservation, through the utilization of the millions of tons of this waste material suitable for roadway construction. Continued and increasing recognition of the material's worth is sure to follow each new successful experience in its application.

MR. BLAIR: Mr. Chairman, I am not going to detain you but a moment and I may surprise you by what I am going to say, in view of what the Honorable Chairman has suggested that I might possibly say. I was particularly refreshed by the statements made by the Mayor of Lawrence, Massachusetts, in all he did say and I believe that the lesson suggested by what he said, was one of the most valuable given to this convention. I am unacquainted with the writer of that paper, I know but little about the pavements of Lawrence, Massachusetts, made of granite, but I do subscribe to what he says based upon his description of the manner and method in which his pavements are built, and therein to me lies the most valuable suggestion in all of the papers that have been read and the greatest lesson to be drawn from them. It is the manner and method of building a pavement rather than the type from which you get the greatest efficiency. We have heard a great deal of suggestions for maintenance; we have said to build the roads and maintain them

and maintain them and maintain them, but here we have a witness coming before us who says the pavements that he builds do not require repairs, and he says it is a hard thing to believe, so that his suggestion comes with a little doubt in his own mind as whether he ought to make the suggestion. Now I want to emphasize and support what he has said by one little statement in reference to a particular experience. In 1901 in the city of Cleveland, Ohio, a medina block pavement was laid, as he describes, around the southwest corner of the square. It has borne as heavy traffic as that city affords upon any of its streets, and every hour and every minute since that time it has grown better without one single cent for maintenance, and it will continue, in my judgment, to grow better for years to come. Now then, out of the same material precisely on another and an adjoining street, with traffic not so heavy, a pavement has been built, which is a miserable dirty, filthy, unsanitary pavement, not fit to live upon or walk upon or use, and it has been so since it was built. I have sometimes heard it said that in compelling a team to draw a load over that pavement the team is compelled to lift the load one-fourth that distance at an angle of 45 degrees. It is the manner and methods in which the pavements are built, and we must not hide behind the fact, we engineers of the country, that the construction is badly supervised, that we have inefficient inspectors. It is upon us to assert ourselves and see that the roads are built exactly in accordance with the specifications and built at their best. I am sometimes heard to say, and I am only going to speak a word with reference to brick pavements, that the brick pavements of this country ought to be built and are built, so that they will grow better for years to come instead of depreciating from the hour that they are built, and it is so and I am glad to be supported by this paper. I am glad that this paper has been read. I myself have built like pavements 30 years ago. The time will come, although it may come slow, when we will understand that we can build hard pavements out of stone and granite and brick that are the most sanitary in the world.

THE CHAIRMAN: There is an old saying and a true one that the common people heard the Lord gladly; He talked to them in their own way and from the point of view that they would understand. We have gone after the country road and the intertown road into the cities where these strong, able pavements are a matter of course. The curse of the cities of our country has been that the choice of the pavement has been left to the selection of abutting owners and not as we have them today, under the supervision of our highway commissioners. An illustration of how people's minds change is best shown in a pavement that was laid in New York City in 1874. One of those pavements was called the Gada pavement, a granite pavement, and it remained there until 1894, and I presume that that pavement had about as much traffic as the Appian Way had

from the day it was laid till the present time, and yet it was covered over afterwards, because it was noiseless, by an asphalt.

We now come down to the people's highway, the roads the farmers built in this country, 2,200,000 miles of road, and they built them themselves without any assistance. Now there's a whole lot of people who want to know what we are going to do with this great question of over 2,200,000 miles of earth roads that are still not under anybody's care and have not been improved. Only 10 per cent of the roads of this country are improved, and I am glad my friend Cooley is to talk to you this afternoon on this great question. I take great pleasure in introducing Mr. Cooley.

MAINTENANCE OF EARTH ROADS

BY GEORGE W. COOLEY

State Highway Engineer of Minnesota

I beg permission of the Program Committee and the delegates present, to change the title of my paper from "Maintenance Methods and Relations to Traffic" to "The Maintenance of Earth Roads." This change is made for various reasons:

First, we all know, either through our own experience or from the experience of other investigators, that the economic value of a highway depends to a great extent on its surfacing, and the care with which that surfacing is kept up. The nature of the material used for surfacing, its value as to hardness, toughness and its recementing quality is generally determined from the conditions of each individual case, but one factor remains forever the same, one rule must be continually in force, and that is a continuous and thorough system of repairs and maintenance. Without the careful carrying out of such a rule, the best of roads will deteriorate, the cost of transportation will become greater with each day's neglect, and our road will become a liability instead of an asset. By far the greater proportion of our roads, especially those in States having a large mileage and a moderate road fund, are the common ordinary earth roads either built entirely from the material at hand or covered when permissible, with a surfacing of gravel, sand, stone or clay, as necessities warrant, or conditions permit.

In the consideration of this subject, it is presumed that the fundamental principles of road construction have been followed, i.e., that an ample drainage system has been provided, and that the subgrade or foundation has been built up without the use of perishable material. Unless our road has been so primarily constructed, weak spots will develop when the drainage is imperfect or where sods or vegetable matter has been used in its construction, and the cost of proper maintenance will become excessive.

In the construction of a new earth road made in an open level or rolling country, the use of an elevating grader is quite common and

under suitable conditions its use is justified by economy in construction work, but its value as a road builder is lessened if the two frequent result is obtained of casting the sods into the road bed, and depending on the regular traffic to thoroughly consolidate the mass so built up. This can be avoided by the use of a tractor in hauling the grader, which thoroughly pulverizes and packs the material cast in by the grader.

We may safely take it for granted then that in any road bed carelessly constructed with a large percentage of vegetable matter, the future bills for repairs and maintenance will be governed largely by the quantity of unsuitable construction material used, and in case of a lax system of construction, a more elaborate system of maintenance must be adopted.

I quote the following from Mr. L. W. Page, director of the office of public roads:

Overtopping all other road problems in its importance is that of maintenance. The destructive agencies of traffic and the elements are unceasing in their activities, and it is idle to talk of permanent roads any more than to speak of a house, a fence or railroad ties as permanent. The public roads today, by reason of the exceptionally obstructive traffic conditions, are more costly in construction and this cost is continually increasing with the advance in the prices of labor and material. It is criminally wasteful, therefore; to invest large sums of public money in building the highways demanded by traffic, unless the investment is conserved by adequate maintenance.

We conclude, therefore, that continuous maintenance being such an important factor in the general scheme, especial effort must be made to install a satisfactory and economical system as soon as a road is opened to travel. In some of our western States, the plan has been suggested of requiring contractors on surfaced roads to provide for maintenance as soon as any section is completed, and continue the same for at least thirty days after the work is accepted, thus giving time for the engineering department to provide for the organization of a maintenance crew without overlapping or interfering with the work of construction: and in Minnesota the plan has been adopted in the construction of earth roads to require the continual use of a drag or planer on grade building. This latter plan has been found very efficient and renders future work on the surface less expensive, besides tending to produce a more compact road bed. The tool found most satisfactory in this work is that known as the "Minnesota Road Planer" which consists of the two blades of an ordinary road drag, fixed between a pair of runners about 14 feet long, the blades set at an angle of about sixty degrees to the runner and made rigid or adjustable as may be deemed best. The planer is hauled on a line parallel with the axis of the road and its operation is similar to that of the ordinary drag, with the additional advantage of making a smoother surface. The old style drag without runners has a tendency, especially on new work, to increase the "waves" or undulations frequently occurring on road construction, while the planer eliminates these faults, and as a general maintenance tool has proven the most satisfactory.

An important feature of maintenance is prevention of the growth of sod and weeds along the travelled track. When sod is allowed to form along the highway, it has a tendency to catch the dust and wash from the road surface, and soon becomes a high tough shoulder, preventing drainage. The use of a spring tooth harrow along the roadside two or three times a year will prevent this growth.

The State of Minnesota has given special attention to the matter of maintenance and in the present road laws have made adequate provision for the care of all roads. Township and county roads constitute approximately 90 per cent of the road mileage of the State, and of these roads, about 90 per cent are earth roads. To care for the town and county roads, a one mill tax is levied on all property in the town the proceeds of which constitutes the town dragging fund. This fund is expended under the direction of an overseer, appointed by the town board, for the purchase of drags, and in dragging all roads of the town, excepting State roads. This appears to be the most satisfactory method of caring for the earth roads under control of the local authorities, but there should be a provision in such cases, for general supervision of the work by the county highway engineer.

For the care of State roads in Minnesota, 20 per cent of the State road funds, with a due proportion of county funds, are set aside and may not be used for any other purpose than maintenance of State roads. As the State roads include all types of construction, different systems of maintenance have been required in the different localities. In general, three systems have been established: The patrol system on macadam and well built gravel roads, and the maintenance section system, and road drag system on other roads, all being under the direct supervision of the district highway engineer.

Under the patrol system, one man is assigned a section of from 5 to 7 miles of road and works with hand tools. It has been found necessary to supplement this work with the occasional use of a team and in that manner it has proven satisfactory on macadam and gravel roads.

Under the maintenance section system, one man is given charge of a section of from 20 to 30 miles of road and is employed continuously with his team on the care of his section. He is given authority to employ additional help, both teams and men, and usually has two teams and four or five men at work. Contracts are also entered into by the section foreman with residents along the road, for the dragging of same after each rain, or when ordered to do so by him. The section crew takes care of all minor items of construction, such as placing culverts, etc., and we have found that the work when properly done, is really of a constructive nature. This system is without doubt the most effective, and is being adopted generally throughout the State.

The dragging system requires the employment of a superintendent of maintenance, who for convenience should be one of the engineer's assistants, whose duty is to contract or make arrangements for the

dragging of all roads under his charge, and to see that the work is done at proper times. This system is suitable for slightly undulating prairie country, where most of the roads are of earth, and to get best results, the superintendent should have at his disposal light graders to reshape the road bed at least at the beginning of each season.

On earth or gravel roads, no maintenance system is complete which does not contemplate the use of planers or similar devices, and a combination of work as outlined under the section system is recommended.

I have been asked to state something about our plan of raising funds. We have a law by which we levy a tax of one mill on the total assessable property of the State. That gives us \$1,500,000 every year, which we distribute in such a way that no county shall receive less than 1 or more than 3 per cent. That money is allotted to the counties in the office of the State engineer under a plan whereby the county having a valuation of \$5,000,000 pays 20 per cent and the State 80 per cent; a county having between \$5,000,000 and \$10,000,000 pays 30 per cent and the State 70 per cent; a county having a valuation between \$10,000,000 and \$15,000,000 pays 40 per cent and the State 60 per cent, and in all other counties, the State pays half and the county pays half. We have a district engineer in every county in the State who has a supervisory control of all work done in the county. Before payment is made on any work, it must be approved by the district engineer.

THE CHAIRMAN: Mr. Diehl of the Committee on Resolutions desires to make an announcement.

MR. DIEHL: I would like to say, gentlemen, that the Committee on Resolutions met this morning and afternoon and will hold another meeting this evening. They desire to present their report at tomorrow's session and therefore request all delegates who so desire to present their resolutions in order that they may be considered at the Committee meeting this evening.

THE CHAIRMAN: The discussion of the "Earth Roads" will be continued by Mr. H. R. Carter, who is the State Highway Engineer of Arkansas. That State has made a recent appropriation of \$1,250,000 which has been placed in his charge. The State has some 36,000 miles of roads and they have improved about 1000 miles as I understand it, sand-clay roads. We will be very glad to hear from Mr. Carter in regard to this great question.

Mr. Chairman and Gentlemen: Unfortunately, I did not arrive as early as I should have and as a result I have been unable to secure a copy of Mr. Cooley's paper, however, if I had secured it I am sure I could not have found many more points to discuss because he has covered his subject thoroughly.

In Arkansas our problem is now and will be for some time in the future, a problem of the construction and maintenance of earth roads. I might say though, as the chairman has told you, that we now have approximately 1000 miles of improved roads, I mean by improved roads, gravel, water bound macadam, tarvia, bituminous macadam, and concrete roads. I merely mention these facts in order that you may become more conversant with conditions that exist in our State. We built the best possible roads with the money available.

The speaker does not desire in any way to criticise Mr. Cooley's paper, but there is one point, although a small one, that I would like to discuss for a short time, that is, the use of the road drag. Mr. Cooley mentions in his paper that in Minnesota a road planer is used which replaces the old road drag, his reasons being that the planer eliminates waves. In other words, the Minnesota planer is used for a cutting tool as well as for a drag. I do not think excessive waves will form if the road is properly constructed, I mean by this that if weeds or other perishable matter is eliminated, drainage properly cared for and the road thoroughly dragged as often as is necessary.

Mr. King the father of the split log drag has said that his drag is based on the principle that the top surface puddles in successive layers and that the action of the sun as result of this puddling produces a baked surface or a sort of a sun-brick, which sheds the surface water. The strength of this crust increases in proportion to the use of the drag. If these are facts the use of a planer or a cutting tool, it occurs to me, would destroy just the results we desire, i.e., the sun-baked surface. I wish to here state that we have never used the Minnesota planer in Arkansas and it is for this reason I have raised this point hoping that it will be discussed by others present.

In conclusion, I desire to congratulate Mr. Cooley on his paper and hope we will meet again.

MR. COOLEY: Referring to the use of the split log drag, I am willing to concede that the split log drag will do almost everything, but I know this, that nearly all of our country roads are soft, constructed of soft material. Now you cannot throw up a country road of the material we have in the western country and find it uniformly homogeneous all the way through, there's bound to be some places softer than others, and those are the places that make chuck holes to a certain extent. Of course if a road is properly constructed, it might not do so, but under ordinary conditions there will be chuck holes every once in a while. If you put an ordinary split log drag on that road you will find that the ends of the drag will dip down in some of those holes and won't be as effective as if the drag is encased in a frame about 14 feet long, because it will shave off the highest point and deposit the material in the lowest. I have been using those drags for 14 years and the best ones I found

were made of 2 x 4. I find that the planer was quite satisfactory in every respect and I would be glad to demonstrate it by the picture of the machine which will convince anybody of its merit. It is really a very satisfactory machine. There is no patent on it.

MR. BLAIR: Please tell us how you drain the roads in Minnesota?

MR. COOLEY: It is all surface drainage except that in some of our roads we have put in catch basins on the side, the same as here, and the water is carried across the road instead of over, but nearly all our drainage is surface drainage. We make our roads about 30 feet wide, 30 feet from the foot of one slope to the foot of the opposite slope, with a wearing surface of about 14, 18 or 20 feet and two ditches about 5 feet wide.

MR. BURGESS (of Illinois): In defence of Mr. Cooley's paper, I have got one to stick into the road drag. Up in our country—I live in central Illinois, and I might as well say that I am a farmer, a stock man; as I said at one of our State meetings, I live in the country 4 miles when the roads are good and 20 miles when they are bad. I started into the road business because our commissioner had turned down a mile of macadam road at no expense to the community and the people thrust the job on me. We spend \$5000 for road work in our township, 6 by 8 miles square, every year, and the roads were no better than they were 20 years before. I bought a gas tractor, used some horse graders we had on hand and wore out an old leveler made right in the neighborhood, and finally bought a heavier machine. I put up my grades so we had a good crown, good gutters on each side that carried the water to lateral ditches. Our county is underlaid with big dredge ditches and smaller laterals to them, so the only drainage we need is surface drainage. I made an average crown of 2 feet to the gutter, so that water, when it falls runs off into the gutters and is carried to the ditches. We leave the ditches open. There is a good deal of tile, but because of our black mud the ditches become puddled and the water must be carried off by surface drainage. With tile you have to dig catch basins to let the water down, but it is not necessary with us when we get our roads up, the water runs down to the gutters. In our part of the country the drag is a complete failure. Mr. Johnson our State Engineer for several years—came there and put up some improved roads, in fact he put me on to how to build these roads. After we got them up he said, "Now I want you to drag them; drag them," and fixed me up three different kinds of drags. The drag was a failure, because we never could get them wet enough and they would roll up under the drag. We could go out and drag in a rain but it would still roll up. There are two periods we can drag, when they are frozen and will thaw down an inch or so and just before freezing it will do all right. Instead of using that sort

of drag, we have a machine that we call a Monroe leveler. I have no connection with the Monroe people; Monroe is a farmer and this machine is built with I-beams and carried on four wheels. The I-beams are about 30 feet long and are fitted with cutting edges. After you put the grade up once, they will go clear to the gutters and bring in the dirt gradually. Then we use what we call a pulverizer behind that. That spreads the dirt instead of leaving it in a potato ridge, as we call it. Everybody has this machine and we use a heavy block behind this that spreads it out, grinds up all the little clods and leaves the top pleasant to travel on. I have found that the important thing in building a road is to fix the top, the center, so that the traffic will stay on it when it is muddy. Our grades are brought up with a good slope so that you cannot travel the sides when it is muddy. Mr. Johnson said, "After you have a good heavy rain, 'phone me and I will come up and show you how to do this;" when I 'phoned he came up and said, "I have heard there was soil you couldn't drag and you have it." This Monroe leveler is the only thing we can use; with it we can cut off the little knobs and level it down and work it just as quick as we can get an engine over it. We work the roads every day they are fit to work, and if you come through our township, no matter which way you go though it, you know it is Bement Township by the roads. We have the best roads in the state; we maintain them every day, and if you don't do that, you can't have a good dirt road.

THE CHAIRMAN: I am glad the last speaker brought that up. I always felt that we never devoted enough time to the question of earth roads. The commissioners that come from the East and New England where this great movement started, with them it is a question of refinement in road building—here this great country is lying in the mud. We ought to have more time for drainage and more time for earth roads. I am very glad to know that we have with us today one of the pioneers in road building. We have all gone to Massachusetts, the dear old State, when we want to learn something. They always receive us pleasantly and give us all the information at their disposal. I know of no State in the Union that has assisted more in the development of road improvement than Massachusetts. We have with us today Colonel William D. Sohier, Chairman of the Massachusetts Highway Commission, who will tell us how to take care of these great highways and what they have done with surfacing.

ROAD MAINTENANCE

THE MAINTENANCE OF SURFACED ROADS OUTSIDE OF CITY PAVED
STREETS AND NOT INCLUDING CITY PAVEMENTS

BY COL. WM. D. SOHIER

Chairman Massachusetts Highway Commission

The absolutely essential prerequisite to a good road is proper drainage. If the road has not proper ditches and proper drains to carry the water away from the road at all times, it will soon become either a bog or a ditch. The second absolutely necessary condition is drainage. If the road has not the proper foundation properly drained to carry off the water into the ditch or drain the water away from the road, the road will soon become worn out, rutted, and a bog-hole. The third absolute necessity is drainage. If the road does not have a surface properly constructed and at all times proper maintenance so that it will carry the water off of the road surface at all times, holes will soon develop and then ruts, and the road will be rapidly disintegrated and worn out.

And that brings me to the absolute necessity of constant maintenance at all times in order that the road surface may at all times carry off the water and contain no holes or ruts which can hold water.

If the road is to be properly maintained, it must in the first instance be properly constructed.

The materials and methods used must be adequate to withstand the traffic that goes over the road without serious deterioration in a few months or even a year or two. This means that the road surface as much as the bridge and the road foundation as much as the bridge foundation must be able to stand without being destroyed the heaviest moving load that is going over it.

I am giving a number of tables showing the cost of maintenance in France and England and Massachusetts, with some tables on traffic that will illustrate this point. We can well learn something from the experience of other countries where road building has been a science for nearly 70 years in France and for the last 25 or 30 years in England.

. MAINTENANCE OF FRENCH ROADS

They established their French road system beginning in 1826, and constructed their total road system of 371,000 miles in about the next 25 years.

Their roads, practically uniform except as to width, have been built almost entirely of local macadam originally, 6 or 8 inches deep on a proper foundation. In resurfacing some of the main roads in later years they have used a harder stone and Welsh or Belgium granite. The macadam surface of the road on the Routes Nationales is 24 feet; Routes Departmentales, 18 feet, and the roads

de grande communication and d'intérêt commun, 15 feet. The yearly cost of maintenance has been \$273 a mile on the Routes Nationales, this maintenance cost varying to \$78 a mile on the 184,000 miles of ordinary country road of only local interest.

The French engineers last spring estimated that some 8000 miles of road ought to be resurfaced, using a tar macadam, because of the large increase in automobile travel around the cities, which travel was rapidly destroying their macadam roads, and they requested the government to furnish \$60,000,000 for that purpose, about \$7500 a mile.

Their greatest problem for over 50 years has been maintenance. The roads are maintained practically by a central organization. The whole country is divided into 86 departments, and all of the county and rural roads within the department are managed by the prefect of that department, and the expenditures appropriated by the council.

Direct charge is in the hands of a centralized body of competent engineers, about half of whom are graduates of the National School.

Each department is divided into four or five political districts, each district being called an *arrondissement*, and the roads are in charge of a district engineer, who is under the direction of the chief engineer.

Each *arrondissement* is again divided into districts or cantons, and an assistant road engineer under the direction of the district road engineer looks after all the county and rural roads within the canton.

Then comes the final subdivision, where the roads are divided into sections of a few miles long, taken care of by patrolmen. All of these are under civil service and the men are promoted from time to time according to their ability.

The table shown below gives the approximate cost of maintenance on the French roads, annually:

	Miles	Total Expense	Per Mile
Routes Nationales.....	23,800	\$6,500,000	\$273
Routes Départementales.....	8,100	1,500,000	185
<i>Chemins Vicinaux</i>			
De grande communication.....	107,300	16,900,000	157
d'intérêt commun.....	47,500	6,000,000	126
ordinaires.....	184,700	14,500,000	78

Five or six patrolmen are under a foreman who is also a patrolman. When any resurfacing or reconstruction is to be done they use machinery, rollers, etc., belonging to the department and collect together enough of the patrolmen, with a section foreman, to reconstruct the road under the supervision of the district engineer. This provides them with men who are thoroughly familiar with the work.

You will note that the French engineers state that on the main roads near the cities the \$273 a mile a year for maintenance is not

keeping the roads up; that they need \$60,000,000 to resurface with tar macadam 3000 miles of these roads at a cost of about \$7500 a mile; that is, practically one-third of their main roads should be of tar macadam. If this expenditure is made in say a five-year period, or \$12,000,000 a year, it will increase the cost of maintenance on their 23,800 miles of national roads about \$500 a mile a year for resurfacing on the average, and will make their total maintenance charge on their main roads \$770 a mile in place of the present cost of \$273 a mile. Of course, if spread over a ten-year period it would only increase the cost half as much, the present roads would be practically impassable. This is in accordance with our Massachusetts experience on our State highways where our expenses per mile including resurfacing averaged over \$850 in 1913.

MAINTENANCE OF ENGLISH ROADS

Originally there was no road system in England. Everyone made his own road. Then came "statue labor" which was required by a general act passed in 1555. This practice was not superseded by Highway Rates until 1835. The roads were cared for by the parishes, and a little later several parishes were combined in a highway district.

In 1663 England began to pass "Turnpike Acts," authorizing the creation of a corporation with trustees, who were to build roads, maintain toll gates and charge tolls.

By 1833 Parliament had passed 3800 Turnpike Acts, and created in England and Wales 1116 Turnpike trusts, controlling 22,000 miles of road. They almost all failed and in the 22 years after 1864 the number of Turnpike trusts was reduced from 1048 controlling 20,589 miles of road to 20 trusts with 700 miles of road.

In 1878 the cost of these main roads which had been disturnpiked was placed upon the counties. In order to even up the expense more or less the English government made appropriations to aid in the maintenance of these main roads, beginning in 1882 with an appropriation of about \$800,000. In 1888 about \$2,500,000 was appropriated, and now the Road Board has something over \$6,000,000 annually which can be spent in improving the main roads.

They have now a combination of the county taking care of the urban and rural main roads, with the parish and local authorities taking care of the rural roads. The main roads are something over 20 per cent of all the mileage, leaving out London.

In almost all of the counties they have sections of road in charge of regular maintenance men. They have almost universally been obliged to give up the old system of patching the roads by putting in loose broken stone from the roadside because of the large number of automobiles that threw it out so rapidly, and they have substituted patches made of either tarred stone or tarred slag, or the patches are made by a painting method using stone chips and dust.

Most of the main roads in England outside of Metropolitan London

and the other large cities, are maintained by the use of tar. Some 40,000 miles of road were tarred in England last year, and some 6500 miles were built of tarred macadam. Their system of maintenance now is not only to keep the roads constantly patched, but every year or twice a year on their macadam roads they usually flush them and roll them filling the holes and depressions first and adding a small quantity of chips and stone dust. On the tarred roads a section man keeps them constantly patched. They usually require a fifth or a sixth of a gallon of tar per square yard which is sprayed on once a year, and this is covered with pea stone or gravel and kept covered so it won't pick up. The tar is usually sprayed on under pressure.

Where they have heavy traffic they are resurfacing their roads with tarred Welsh granite which is like our Trap Rock or with tarmac which is a tarred iron slag. They also build a road of three-inch stone, rolled hard, and grout it with a mixture of hot sand and hot tar, equal volume, poured into the road until it flushes it, and roll in $1\frac{1}{2}$ -inch stone and smaller stone with a surface coat of tar and sand. They find their macadam roads with a tarred surface require re-treatment every year. This costs about $2\frac{1}{2}$ to 3 cents a square yard a year. On the tar-mix roads they require a new coat of a fifth of a gallon of tar applied on the surface every two years.

I am giving you in a table the cost of maintenance on the various classes of road in England, in which you will see that the average cost is \$1100 a mile a year to maintain the county urban main roads, and the county rural roads \$431 a mile a year, while the rural roads which are merely of local interest cost about \$122 a mile a year to maintain.

	MILES	MAINTENANCE	AUTHORITIES, COUNTY ENGINEERS	YEARLY MAINTENANCE PER MILE
County Councils:				
Urban Main Roads.....	4,189	\$4,601,790	61	\$1100 431
Rural Main Roads.....	23,565	10,177,740		
	27,754	14,779,530		
County Boroughs.....	9,366	6,437,380	28	685
London Authorities.....	2,192	3,691,355	2	1680
	11,558	10,128,735	30 Road Authorities 1733	425 555 122
Urban Roads.....	11,411	4,843,020		
Urban Roads.....	4,871	2,701,710		
Rural Roads.....	95,077	11,562,920		
	111,359	19,112,650		
Totals.....	150,671	\$44,020,915	1898	290

The total expenditures per year, including improvements and interest, \$75,990,000.

CONSTANT MAINTENANCE

In both France and England they keep the roads constantly patched. But in France near the large cities where there is a large amount of automobile travel, they have been unable to keep their water-bound macadam roads in good condition. Many of them are rough with a large number of pot-holes. Around Paris they have replaced the water-bound macadam with a tar macadam top 3 inches in depth on many of the roads that were undoubtedly worn out and rough and impassable five years ago.

In both countries on the main roads they keep section men constantly patching the roads. They add a little additional stone, flush them out and roll them every year. On the main roads where there is much automobile travel they are using tar in making their patches, as they found that the old method of putting on loose broken stone and letting the traffic roll it down is of no use because the automobiles throw the stones out over the road.

They are patching by two methods, more commonly using a tarred stone or tarred slag with tarred chips, cutting a square edge if there is a pot-hole and tamping the tarred material in. The largest stone used are at least three-quarters of the depth of the hole. In other places they are merely painting the little place where the tar fails and covering with pea stone or pea gravel.

In resurfacing in both countries they are using a large stone about the 3-inch size. In France where there is not a great deal of tarred macadam they are using a hard Belgium granite on the main roads, doing one-half the width at once.

In England they are using the same large size stone coated with tar or a tarmac (tar-coated iron slag). Most of their engineers use very little small stone with it. They use practically all large size with tarmac as it compacts under the roller. Some of the county engineers use 10 per cent of the fine material. They also do one-half the road at once. The engineers state that they have been forced to use this larger stone in resurfacing because of the motor trucks and the large number of traction engines with trailers. Our practice in Massachusetts is the same, except that we are very often on heavy traffic roads using asphalt or some asphaltic bitumen rather than tar because our experience leads us to believe that it is worth the additional cost for the material.

We are also in Massachusetts—somewhat experimentally as yet as we have only done three or four miles—resurfacing with the tar and sand mixture grouted into the three-inch stone described above.

In England, France, and Massachusetts we have found it necessary and economical with the change and increase in traffic to very much diminish the crown of our macadam roads.

Formerly with macadam surfaces 15 feet in width we used a crown of three-quarters of an inch to the foot. We now try to secure about a quarter of an inch to the foot on our bituminous macadam roads, and in resurfacing the old roads we are widening the macadam sur-

face to 18 feet in place of 15, as our experience shows that traffic otherwise will spread over the edge of the road and rapidly sheer down into the macadam and narrow the road up.

In England they have been forced to do the same; to wit, widen the road and diminish the crown, because they found that the traction engine with trailers, of which they use large numbers, would shear down into the macadam, thus rapidly destroying their older roads. They now universally use a crown that does not exceed one inch to the yard.

The result of this in England and Massachusetts has been that the traffic has spread all over the road, that no rut has developed and no horse track, a tremendous change from a few years ago when the center of the road as a horse track wore down quicker than the sides.

In traveling over 2,000 miles of road in England this year and last, I didn't see a single rut and practically not a single pot-hole.

MAINTENANCE OF STATE HIGHWAYS IN MASSACHUSETTS

Our Commission began building roads in 1894. The earlier roads were almost entirely macadam with a few miles of gravel or graded road. The standard road with necessary foundation and proper drainage wherever necessary was 15 feet in width, water-bound macadam either of trap or local stone, 6 inches deep in the center and 4 inches on the sides, with a 3-foot gravel shoulder on each side and with a three-quarter-inch crown to the foot.

The ordinary cost of maintenance I am giving in a table, but up to 1907 when some of the roads were 12 years old, the cost of ordinary maintenance was substantially \$100 a mile a year. Ordinary maintenance with us consisted merely of keeping the gutters, catch basins, and drainage, open and clean, cutting out the grass and brush on the roadsides, keeping the shoulders in proper condition, spreading a little gravel or sand on the road surface from time to time and filling the few holes or ruts that might occur, with broken stone or gravel. Very few miles of road had been actually resurfaced prior to 1907.

In 1906 the automobiles began to come. Our roads were some of them 13 years old and only half the original depth of stone was left. We soon found that automobile travel, especially at high speed, disintegrated or tore up the macadam or gravel roads, especially on the curves, as soon as there were any considerable number, say 50 or more in a day. The traffic, of course, increased tremendously in the number of vehicles, because of the large mileage of the automobiles. What had been country roads developed, between that year and the present year, into main through routes carrying oftentimes away out in the country on a main route over 1000 cars a day.

TRAFFIC AND COST OF MAINTENANCE

In connection with maintenance, of vital consideration is traffic. I, therefore, am submitting a table showing the average traffic on the Massachusetts State Highways in 1909 and 1912.

Increases and Changes in Traffic from 1909 to 1912

In Massachusetts the traffic using our roads is constantly increasing, but it is changing much more rapidly than it is increasing. This is conclusively shown by the following table.

KIND OF VEHICLE	1909 CENSUS, 238.5 STATIONS			1912 CENSUS, 156.5 STATIONS			
	Av. total per day	Av. No. per day per Sta.	% of No. per Sta.	Av. total per day	Av. No. per day per Sta.	% of No. per Sta.	Increase or de- crease, %
<i>Motors:</i>							
Runabouts.....	4,958.5	20.8	8.5	5,819.0	37.2	11	+79
Touring cars.....	17,950.5	75.3	30.5	27,178.5	173.5	49	+130
Trucks.....				1,800.0	11.5	3	
Total motors.....	22,909.0	96.1	39.0	34,797.5	222.2	63	+131
<i>Horse-drawn vehicles:</i>							
1-horse, light.....	17,033.0	71.5	29.0	8,380.0	53.5	15	-25
1-horse, heavy.....	11,762.5	49.3	20.0	7,458.0	47.6	14	-3
2 or more horses, light.....	1,006.0	4.2	2.0	556.0	3.6	1	-14
2 or more horses, heavy.....	6,205.5	26.0	10.0	3,870.5	24.7	7	-5
Total horse-drawn.....	36,007.0	151.0	61.0	20,264.5	129.4	37	-14
Totals of all kinds.....		247.1			351.6		+42

Also, a table showing the traffic on certain roads at night.

We had a count made for 24 hours a day at a few points, and the result may be interesting, so I print a short table.

Day and Night, 12 hours each—October, 1912

	AUTOMOBILES		VEHICLES (ALL KINDS)		TOTAL VEHICLES	PERCTGS. AT NIGHT
	Day	Night	Day	Night		
Lexington.....	302	59	438	104	542	19
Watertown.....	373	72	671	141	812	17
Chelsea.....	103	10	358	53	411	13
Somerville.....	266	70	689	231	920	25
Boston.....	358	69	513	94	607	15

I computed several night and day counts for the two years to get an average, and found that on the average the night traffic constituted about 18 per cent of the total traffic; consequently, one should add about 22 per cent to the 14-hour day count to ascertain the total number of vehicles.

And the traffic in some of the parks around Boston.

Pleasure Traffic Around Boston

The census near Boston in the parks may be interesting, but it must be remembered that it is, in many instances, light pleasure traffic. The following figures relate to the census taken in August, 1912.

Metropolitan Parks
(Mostly Pleasure Vehicles)

LOCATION	TOTAL OF ALL VEHICLES	MOTOR VEHICLES	% MOTOR TO TOTAL TRAFFIC
Lynn, Prescott Pl. & Shore Res.....	1,530	1,411	92
Revere, Saugus River Bridge.....	1,872	1,808	97
Somerville, Alewife Bridge.....	491	474	97
Medford, Parkway and Main street.....	515	492	95
*Somerville, Wellington Bridge.....	2,528	2,174	86
*Milton, Mattapan Bridge.....	2,383	1,717	72
Medford, Malden River Bridge.....	1,884	1,848	98

Boston Parks
(All Classes of Vehicles)

Prince St., Jamaica Plain.....	1,934	1,715	89
Commonwealth Ave., a city residential street.....	3,009	2,634	88
Washington St., a suburban city avenue...	1,109	671	60

* All classes of vehicles.

At the last two points there were daily 247 and 296 heavy teams. I am also giving a table showing the cost of construction, repair, and maintenance of State highways in Massachusetts for 19 years.

Cost for Construction, Repair and Maintenance of State Highways, from 1894 to 1913

REPAIR AND MAINTENANCE			STATE HIGHWAYS		
Year	Cost	Miles	Av. cost per mile per year	Miles laid out	Cost of Construction
1894				39.88	
1895				50.03	\$637,847
1896	\$4,727	89.10	\$53.05	37.02	458,581
1897	13,267	126.01	105.28	53.25	482,076
1898	20,661	179.26	115.26	42.68	499,783
1899	24,538	221.94	110.56	44.56	407,309
1900	33,562	266.50	125.93	49.40	396,459
1901	31,061	315.90	98.32	61.68	453,826
1902	59,943	377.58	158.75	53.32	466,743
1903	55,083	430.90	127.83	74.17	443,972
1904	51,896	505.03	102.76	60.85	445,745
1905	57,456	565.88	101.53	56.55	509,007
1906	68,382	622.45	109.86	47.92	444,655
1907	106,189	670.37	158.40	39.33	467,944
1908	147,037	709.70	323.47	38.40	564,719
	82,628*				
1909	247,985	748.27	537.39	36.53	431,814
	154,131*				
1910	214,561	784.80	642.28	52.80	462,165
	289,498*				
1911	213,476	837.59	632.86	42.00	412,542
	316,603*				
1912	208,687	879.59	708.39	40.72	366,424
	414,407*				
1913	203,762	920.31	868.13	60.06	909,063
	595,183*				
				980.88	9,262,674

Average cost of Repair and Maintenance, 1895 to 1907, inclusive, \$105 per mile per year.

Average cost of Repair and Maintenance, 1908 to 1913, inclusive, \$619 per mile per year.

Average cost of Repair and Maintenance, 1895 to 1913, inclusive, \$267 per mile per year.

* Motor Vehicle Fees Fund.

In this connection I am giving a table showing the number of motor cars registered in Massachusetts from 1906 to 1914 inclusive. You will note that the number of automobiles registered has increased from about 7300 in 1906 to over 84,000 in 1914, and fully one-third of the traffic on our main roads consists of automobiles from other States.

You will note also that there were less than 1000 trucks registered in 1909 and five years later in 1914 there were 8000—8 times as many.

Statement Showing the Number of Motor Cars Registered and Licenses Issued 1906 to 1914

	1906	1907	1908	1909	1910	1911	1912	1913	1914
Autos (pleasure).....	6,572	7,733	13,066	23,011	29,792	36,284	46,096	56,712	68,100
Dealers' autos.....	755	455	1,905	2,455	3,305	4,920	6,301	7,462	7,898
Trucks.....				960	1,568	2,623	4,036	5,948	8,053
Operator and chauff.....	7,327 10,083	8,188 10,696	19,971 13,170	26,426 18,251	34,665 41,259	43,827 51,950	56,433 66,645	70,122 81,034	84,051 95,577
Total Receipts.....	\$33,085	\$92,096	\$121,488	\$169,973	\$374,789	\$477,417	\$616,245	\$764,153	\$914,119

Prior to 1907, certificates of registration did not expire annually.

Prior to 1909, trucks were not classified.

Between 1903 and 1907, all automobile registration fees were \$2.

In 1907 the automobile registration fee was increased from \$2 to \$5. In that year 9006 cars, registered at \$2, were re-registered in the same year at \$5.

Beginning January 1, 1910, the automobile registration fees were based on the horse-powers of the vehicles, the fees varying from \$5 to \$25. The fee for registration of a truck, however, was \$5 regardless of the horse-power.

Prior to 1910, operators' licenses did not expire annually, but continued in force indefinitely. Since 1910 all licenses have expired annually.

Increase in Maintenance Cost

Starting in 1907 you will note that our cost for maintenance has risen by leaps and bounds from \$158 a mile a year in 1907 to over \$850 a mile a year in 1913, and it is still higher in 1914.

Our roads were rapidly going to pieces. We needed some money. We got the Legislature to double its appropriation of \$100,000 a year and make it \$250,000 for one year and \$200,000 a year since. We secured an increase in the automobile fees, and had four-fifths of that money available for the maintenance of State highways, and the other one-fifth for the improvement or maintenance of through routes in the towns.

We found that our old roads were being destroyed by the rapidly

increasing amount of automobile travel. The traffic on the roads had increased from 10 to 40 times in volume.

Our roads, both gravel and macadam, were rapidly being torn up by the automobiles and deposited in dust over the country. They were rutted, pot-holes developed, and, as you see, we had to increase our maintenance cost. The question was, how to best preserve our old roads.

In 1907 we began to use a bituminous material as a surface coat. We used refined tar and a heavy cold asphaltic oil, applying about one-half gallon to the square yard.

Proper Methods for Economical Maintenance

In passing let me say as a result of our experience in the use of bituminous binders on road surfaces, that we invariably true up the surface and patch the holes and ruts first. We invariably thoroughly brush and clean the road down to the stone or hard gravel. We invariably spread our bitumen, whether tar or asphaltic oil, evenly and under pressure. We invariably cover it and keep it covered so that it will not pick up, brushing the cover back from time to time when necessary. We cover it with pea-stone and dust, unless we can secure a good pea-stone in sand or gravel, or we coat it when the other method is too expensive and traffic is light, with a coarse sharp sand. Thereafter, constantly and eternally, we keep the road and road surface patched, using in patching substantially the same bituminous material that was used for the surface coat.

We used one-half gallon per square yard of heavy asphaltic oil that had to be heated to 250° spread upon the road. We used the same quantity of the heaviest oil that could be spread cold. Where we had only money enough for a dust layer, we used one-fifth to one-quarter of a gallon of light asphaltic oil per square yard, this oil sometimes being called a 40 per cent oil. We used one-half gallon of hot refined tar, and we have used after the first application one-quarter of a gallon of the same tar yearly. We have used water-gas tar and various proprietary materials of a bituminous nature known by various trade names. In every instance that has succeeded the road has always been properly cleaned and patched beforehand, and has always been covered and kept sufficiently covered to prevent its picking up. It has been constantly patched.

Surface Coatings of Asphaltic Oils, Tars, etc.

Today nine-tenths of all our State highways that have not been resurfaced have been coated and kept coated with some bituminous material and have been kept constantly patched. Where the heavy hot oil was used, it has lasted in some instances for five years, carrying a large amount of automobile travel but a small amount of heavy teaming. Under many heavy teams it has failed in a month or two. We have then used a light oil to lay the dust and prevent the automobiles from tearing the road up, and have left the stone to carry the travel until we could resurface the road.

Because of the automobile traffic on many main routes, we are now using in our resurfacing a bituminous top two to three inches deep. We have used refined tars by both the mixing and grouting method. We have used asphalts with the same methods, and we believe that use is economical and necessary on any roads that have more than 50 automobiles a day and where there are more than 50 loaded teams.

I am giving a table showing the class and character of surfaced roads that we believe will stand traffic of a certain class, kind, and character—we believe it will prove economical and satisfactory with the traffic.

1914—AVERAGE DAILY TRAFFIC

Table showing results of observations of traffic on different types of road surfaces in Massachusetts—Standard Road, 15 feet in width, gravel or waterbound macadam 5 to 6 inches in thickness, with adequate drainage and proper foundation, with 3-foot gravel shoulder on each side.

	LIGHT TEAMS, CARRIAGES, WAGONS	HEAVY TEAMS, 1-HORSE	HEAVY TEAMS, 2 OR MORE HORSES	AUTOMOBILES
A good gravel road will wear reasonably well and be economical with.....	50-75	25-30	10-15	50 to 75
Needs to be oiled with.....	50-75	25-30	10-15	over 75
Oiled gravel, fairly good heavy cold oil, $\frac{1}{2}$ gal. to the sq. yd., applied annually with.....	75-100	30-50	20	500 to 700 or more
Water-bound macadam will stand with.....	175-200	175-200	60-80	not over 50 at high speed
Cold oil or tar will prove serviceable on such macadam with.....	175-200	175-200	60-80	50-500
Macadam will then stand but the stone wears, of course, with.....	175-200	175-200	60-80	500 or more
Water-bound macadam with hot asphaltic oil blanket will be economical with.....	100-150	50-75	25-30	1500 and more with fewer teams
And stand at least.....				50 trucks
But will crumble and perhaps fail with over..... (on narrow tires, ice, farm and wood teams, etc.)...	150	75	30	
Water-bound macadam with a good surface coating of tar ($\frac{1}{2}$ gal. to the sq. yd.) will stand with.....	100-150	50-75	25-30	1500 or more
but requires to be recoated annually with $\frac{1}{2}$ gal. of tar per sq. yd.				

It is assumed that all road surfaces are kept constantly patched, that before applying bitumen the road surface is cleaned and patched, and the bitumen covered with pea stone and sand or gravel and kept covered so that it never picks up.

Of course, in connection with this table it is absolutely essential that the drainage and foundation are sufficient and the material used is strong enough to carry the heaviest load which goes over the road without the road's being rapidly destroyed.

Materials That Have Not Failed

The foregoing table has been somewhat changed as the result of our experience since 1912 when I first published a like table.

It expresses the consensus of opinion of our chief engineer and four division engineers and my own best judgment.

The results have all been obtained on many miles of road where we have used a good grade of asphaltic oil, either hot or cold, heavy or light, or a good grade of refined tar.

We have had many failures on short sections of road where a non-asphaltic oil was used or a poor grade of oil or tar, and many proprietary so-called dust-layers have failed. Roads that failed have been resurfaced or retreated, but the results are not tabulated in the above table.

The table relates merely to the maintenance of gravel or water-bound macadam roads, not to bituminous macadam.

It represents our average experience on many miles of road at over 150 observation points.

Certain exceptions should be noted.

Army manoeuvres, especially large bodies of cavalry and artillery, will rapidly destroy any bituminous blanket surface.

A blanket coat of hot oil on macadam will carry a much larger number of teams if there is a ratio of two to three automobiles on pneumatic tires to each team to keep the bituminous surface constantly rolled down when the horses and teams pick it up.

But note that a very few teams on narrow tires, or a few very heavy teams every day, will destroy the surface if the load is heavy enough to shear down entirely through the surface to the stone.

If this process is repeated once or twice a day, a rut soon develops and the road becomes muddy and the bituminous surface rapidly disintegrated.

Light oil or cold tar will then be more serviceable, laying the dust while the stone takes the wear.

We have maintained a few miles of road in reasonably satisfactory condition with annual applications of a cold tar or water gas tar. They have required one-half gallon per square yard annually, and the results have been about the same and certainly no better than where we have applied two quarter gallon coats per square yard of light asphaltic oil the first year and one quarter gallon per square yard each succeeding year.

The cost for the cold tar has been more.

Invariably we clean and patch the road first and cover the bituminous material sufficiently to prevent its picking up.

We have sometimes tried dispensing with the cleaning and covering but shall not repeat that expensive experiment.

We can usually have the light asphaltic oil sprayed onto the roads by motor trucks for 1.2 cents to 1.5 cents per square yard, using one-fifth to one-quarter gallon per square yard.

The cleaning, patching, and covering costs about the same.

Maintenance Methods

On gravel roads we have found it necessary to keep them constantly shaped and patched. We drag some of our roads once a week where there are 150 or more automobiles a day. We have found on the

hills that have rutted with that traffic that it was more economical to use a quarter of a gallon per square yard, of light asphaltic oil, using the first year two applications and in subsequent years one, keeping it properly covered. Roads of this character have been extremely satisfactory with the traffic of a very large number of automobiles, certainly 500 a day, but they will not stand a large amount of heavy horse-drawn vehicles and probably will not stand many loaded trucks.

As you will note from the table given before, our ordinary maintenance which has consisted of keeping the drainage open, shoulders cut back, and the road sanded, with slight patching, has averaged about \$100 a mile a year. Where the road can be maintained with light oil, the additional cost is about \$250 a mile a year, or \$350 a mile a year in all. The cost of heavy oil or tar on the surface where it is suitable to use it because it will stand the traffic, is about twice the cost of the light oil in the first instance, and with the patching and all that is necessary it will cost about the same figure, or about \$250 to \$500 a mile a year, this being on a five-year basis.

In resurfacing our roads with two to three-inch bituminous macadam top, the cost has varied from about 50 cents a square yard for a one and one-half inch top no stone being larger than an inch and a quarter, and a gallon and a quarter of tar sprayed into it, to \$1.10 a square yard for a three-inch top, made of two and one-half-inch stone, either mixed or grouted with a good grade of asphalt. The tar-sand grouted macadam has cost from 90 cents to a dollar per square yard. We believe that the roads of this character will have a very small maintenance cost outside of the ordinary maintenance for a period of from eight to twelve years. I am inserting some tables showing the maintenance cost on certain roads compared with the maintenance cost in England on roads of the same character; to wit, water-bound macadam, giving the cost per mile and the cost per ton per mile for each vehicle that is going over them. This figured upon the following formula, which is substantially the same in England and France:

Assumed Average Weight of Vehicles in tons

Motor Vehicles	{	Runabouts.....		1.43
		Touring Cars.....		2.23
		Trucks.....		6.25
Horse Drawn Vehicles	{	Light Vehicles	} one horse.....	0.36
		Heavy Vehicles		1.12
		Light Vehicles	} two or more horses...	0.54
		Heavy Vehicles		2.46

The cost in Massachusetts per vehicle per mile as shown by our maintenance cost and traffic census taken in three-year periods has been substantially one cent a vehicle per mile until we began to use bituminous binders. It now figures about eight-tenths of a cent a vehicle a mile.

Traffic and Maintenance

Quantity and character of traffic.

Economical maintenance and cost thereof.

Materials and methods to be adapted to the traffic that the road has to bear.

ENGLISH ROADS

There is a very interesting and useful paper on construction and maintenance published in connection with the International Road Congress in 1913, this paper giving the experience of five of the most competent road engineers in England.

I am printing a table showing the weight in traffic in tons carried one mile for one cent of maintenance cost.

(All waterbound macadam with or without surface tar)

COUNTY	WEIGHT OF TRAFFIC IN TONS		AVERAGE COST	WEIGHT IN TONS CARRIED 1 MILE FOR ONE CENT	COST OF MAINTENANCE IN CENTS PER TRAFFIC TON-MILE
	Per day	Per Annum	Per mile per annum		
Norfolk.....	39	14,200	\$206.25	.70	1.42
	96	35,000	80.00	4.50	22
Warwick.....	185	67,500	430.00	1.60	62
	239	87,200	635.00	1.45	68
	242	88,300	430.00	2.15	46
*Kent.....	348	126,700	1,495.00	.85	118
Norfolk.....	359	131,000	366.25	3.70	26
	385	140,500	281.25	5.20	192
	390	142,300	275.00	5.35	186
Warwick.....	451	164,600	635.00	2.70	36
Norfolk.....	504	184,000	251.25	7.55	132
Kent.....	528	192,100	1,740.00	1.10	90
Warwick.....	609	222,000	1,345.00	1.70	58
	734	268,000	2,095.00	1.35	74
	736	268,600	670.00	3.95	254
*Kent.....	796	289,800	960.00	3.15	32
E. Sussex.....	984	359,000	1,665.00	2.20	44
Norfolk.....	1,057	386,000	1,090.00	3.65	26
*Kent.....	3,030	1,102,810	10,500.00	1.05	94
	3,030	1,102,810	8,960.00	1.25	80
*Surrey.....	5,694	2,078,300	5,160.00	4.20	24
	5,694	2,078,300	3,020.00	7.15	14

Comparison with two Massachusetts Roads

Beverly.....	2,898	1,058,430	5,257.00	6.50	37
Weston.....	1,920	699,924	1,993.00	7.02	28

* Surface tarred.
Period of 14 years.

I have used the English long-ton but have changed the pennies to cents. This table shows that the cost on water-bound macadam roads to carry one ton one mile over the road, varies from about a quarter of a cent to one and one-half cents for the maintenance. This illustrates very well, I think, the necessity of the traffic census showing the class and character of the vehicles which use the road rather than any formula which merely uses as assumed weight for each class of vehicle.

Massachusetts Experience

We have found on our roads in Massachusetts that the largest cost of up-keep on macadam roads could come from two causes; first, automobile travel, which would disintegrate a plain gravel or macadam road in a month if there were many automobiles. This could be prevented by the use of some bituminous material on the surface, provided the team traffic was not so heavy that it would quickly wear the binder out. A large number of heavily-laden teams, of say three tons or more, would wear the binder out in a very short time. Also, a very large number of heavy loads carried on narrow tires would wear a macadam road out relatively quickly. Some of the roads that I am showing would be worn from a half inch to an inch a year if of macadam, whereas when a bituminous macadam road with a three-inch top was constructed amount of wear was very much reduced.

The necessity for knowing the kind of travel is well shown by the English tables. On one road in one of the counties it cost one and four-tenth cents to carry a ton a mile, and on another macadam road in the same county it cost twelve-hundredths of a cent. It appears from the English figures that when the cost of maintenance exceeded two-thirds of a cent a ton a mile, it was more economical to use granite block on a concrete base. The cost for annual maintenance of a six-inch block on a concrete base near the docks in Liverpool has been fifty-eight one-thousandths of a cent a ton a mile.

I am enclosing a table of some of the costs of different kinds of street surfaces and pavements in Liverpool.

Table giving particulars of experience obtained in Liverpool with different classes of surface pavement—including life-tonnage and ton miles per yard width per cent of cost

PAVEMENT	TONS PER YARD WIDTH PER ANNUM	LIFE, YEARS	LIFE TONNAGE PER YARD WIDTH	COST PER SQUARE YARD OF SURFACE	ANNUAL COST INCLUD- ING PROPORTION OF CAPITAL AND MAIN- TENANCE PER SQ. YARD	TON MILES PER YARD WIDTH PER CENT	COST IN CENTS PER TRAFFIC PER MILE
6-inch Belgium Block.....	524,000	18	9,432,000	\$2.50	\$.17	17	.058
4-inch Belgium Block.....	150,000	50	7,500,000	1.87	.07	12	.08
Hardwood.....	162,000	17	2,754,000	3.37	.25	3.7	.272
Softwood.....	204,000	18	3,672,000	2.12	.15	7.7	.128
4-inch Pitch Macadam.....	120,000	11	1,320,000	.75	.066	10.3	.096
7-inch Water-bound Macadam	120,000	1	120,000		.18	3.8	.264
7-inch Water-bound Macadam Tar sprayed.....	120,000	2	240,000	.25	.12	5.7	.18

Tonnages on Roads Board basis, except on exceptionally heavy traffic when it is based on estimated total actual weights.

English Ton = 2240 pounds.

Traffic and cost on Massachusetts State highways

TOWN	AMOUNT OF TRAFFIC		REPAIRS AND MAINTENANCE				CHARACTER OF TRAFFIC		NUMBER OF VEHICLES PER DAY					
	Total tonnage per day (300 days)	Total tonnage per year (300 days)	Cost per mile per year	Cost per ton miles per year (cents)	Period (years)	Runabouts	Auto-motobiles, touring cars and wagons	Trucks	HORSE DRAWN VEHICLES					
									Single horse		Two or more		Light	Heavy
									Light	Heavy	Light	Heavy		
Ashby.....	271	81,150	\$266	0.38	16	14	65	4	70	16	5	14		
Beverly (No. 1).....	1618	485,220	1104	0.23	15	60	278	8	66	46	4	12		
Hamilton.....	1199	359,730	200	0.06	15	86	334	31	75	39	2	27		
Lynn.....	3468	1,040,430	1081	0.10	9	194	1365	13	28	19	1	14		
Medford-Somerville.....	1332	399,570	1031	0.26	6	44	121	49	47	198	2	193		
Milton.....	1140	342,210	592	0.17	14	15	50	0	30	77	2	88		
Saugus.....	1022	306,660	1334	0.44	14	15	58	78	25	190	3	65		
Shrewsbury.....	1305	391,500	510	0.13	17	76	407	17	64	60	4	36		
Truro.....	186	55,770	143	0.25	17	7	63	1	15	14	1	3		
Weston.....	1918	575,280	1040	0.18	15	115	533	30	167	98	5	59		

* 1909 Report used and results increased 70 per cent to correspond with 1912 report.
Also weight of double heavy teams increased from 2.46 to 5 tons.

Explanation of Table

The above represents actual facts in Massachusetts. It illustrates the misleadingness of statistics if read without adequate knowledge of actual conditions.

The variation in the costs shown are due to various causes, traffic and weight, toughness of stone, whether road has been resurfaced or not, good and bad bituminous materials, and proper and improper use of materials.

A study of each road will prove profitable.

Ashby, with high cost of maintenance, small traffic, can be compared with *Hamilton*, with more traffic and a small cost for maintenance, per ton.

Ashby, built of local stone, comparatively soft, was resurfaced with the same local stone when the road was about 12 years old, 30 tons being used to each 100 feet of road. It is a country road. It had an application of cold asphaltic oil in 1913, one-quarter gallon being used to the square yard of road. Practically, the stone had worn down one-quarter of an inch a year.

Hamilton was built of trap rock macadam and it is on a main through route. When the road was eight years old the stone had worn down about three inches, and the road needed resurfacing. Automobiles had arrived.

In 1907, one-half gallon of the heaviest asphaltic oil that can be applied cold was spread upon the road and properly covered with pea stone and gravel. This treatment was repeated for two years. Then one-quarter gallon of heavy hot asphaltic oil was sprayed upon the road and properly covered; this treatment has been repeated once. The road has been constantly kept patched and sanded when necessary. It is in better condition today than in 1907.

Beverly, with a high cost of maintenance per ton mile, can be compared with *Lynn*, with a small cost per ton mile. Both roads are on main routes. Both were trap rock macadam.

Beverly has a large number of heavy ice teams on three-inch tires. It was resurfaced with trap rock when the road was eight or nine years old, 30 tons of stone being used to each 100 feet of road. The trap rock had worn down one-third of an inch a year. In 1910 it was coated with one-half gallon of hot asphaltic oil per square yard, properly covered with pea stone and dust. This failed in one month under the heavy ice teaming, though the same material and methods were used on the next 20 miles of road on the same route, and the surface has stood ever since with constant patching and one-quarter of a gallon per square yard of the same oil sprayed onto the centre of the road, eight feet in width.

For the next four years the *Beverly* road was maintained (except where it was resurfaced) by the use of one-quarter of a gallon of cold oil per square yard, two applications being used the first year, one each year since.

One-third of the road was resurfaced in 1913 with an asphaltic macadam two inches in depth, at a cost of \$1.20 per square yard, two and one-half-inch stone being used because of the heavy teams and trucks.

Lynn, trap rock macadam, connects with Parkway where only pleasure vehicles are admitted, except on local business.

In 1907, one-half gallon of hot refined tar was sprayed upon the road, and covered and kept covered with pea stone and dust. It was constantly patched, with tar and chips. It has been recoated twice with hot refined tar sprayed upon the road and covered as before.

It is in excellent condition, but note—90 per cent of the travel is motor vehicles; it has few teams and fewer heavy teams.

Medford-Somerville, a trap rock macadam, built with the two and one-half inch stone on top. A road 28 feet in width, with heavy city teaming. A stone quarry on the side crushing 100 to 300 tons of stone a day.

This road has never been in good condition since it was two years old. It always has some depressions, although it has been constantly patched and all depressions filled with trap rock. Constantly means daily. It has always been muddy.

A part of it was resurfaced with asphalt macadam this year, the portion beyond the stone quarries. The whole road needs it. It has been treated with tar. A part of it has been coated with heavy tar. A portion had three coats of one-quarter gallon each of hot refined tar, covered with pea stone, in one year. It failed, was never in good condition, and we are in doubt whether to reconstruct with granite block on a concrete base, with concrete, or to try an asphaltic macadam.

Milton is a road of the same character with many heavy granite teams going over it.

The cost has been high because the trap rock wore out so rapidly under the heavy concentrated loads on iron tires.

Saugus. Trap rock macadam on a through route with a great deal of heavy teaming, both teams and trucks.

The stone wore out over one-half-inch a year. It needed constant patching with additional stone, was never in excellent condition except when recently resurfaced.

It had two to three inches of new stone every four or five years. In 1910 it was resurfaced with three inches of asphaltic macadam at a cost of about \$1 per square yard.

This has stood ever since but has needed some patching. A portion was built in the fall when it was cold and this portion failed. No bituminous work should be done in cold weather and a temperature of over 60 degrees is vastly better than one of under 40.

Shrewsbury. A through route—too much heavy hot oil was used on it before we understood how to use oil. One-half gallon per square yard was applied on two successive years.

It rolled, rutted and was always in bad condition. It has cost a good deal to remove surplus oil, smooth off the bunches and rolls and keep it patched.

Thuro. A country road, with little traffic. Built 12 feet wide of four inches of broken stone on sand, the stone being bound with clay. An experiment but a failure.

The road was constantly ravelling and needed more stone. It was widened to 16 feet. New stone was added and rolled in and it was coated with light oil in 1912 and 1913 and is now in good condition.

Weston. A macadam road on a through route. Refined tar applied in 1907—oiled with hot oil on surface in 1909 and 1910—maintained with patching until 1912 when a portion of the road was resurfaced with a two-inch bituminous macadam.

Two and one-half-inch stones of trap rock were rolled hard and about one and three-quarters to two gallons to the square yard of a good grade of asphalt being sprayed in under pressure. This was covered with the smaller stone, rolled, and on some portions of the road a surface application was sprayed of one-third to one-half gallon per square yard, properly covered with pea-stone and rolled. This cost from 90 cents to \$1 per square yard. The road is in most excellent condition and we expect to have it wear 10 to 15 years with practically no patching, although we may have to renew the surface coating by spraying every three to five years. We have one road of this kind six years old, that hasn't needed a single patch as yet.

Motor Trucks and the Cost of Road Maintenance

Mr. H. T. Wakeland, engineer of the county of Middlesex which is just out of London and has a very large amount of traffic over its roads, has given some very careful figures showing damage caused to roads by motor omnibuses weighing about six tons each when laden. He took certain roads which had heavy traffic and gave the cost of maintenance (not including watering or cleaning) for macadam roads for three years previous to the motor bus traffic, and the cost per square yard for the year 1912-13. I insert a table:

<i>Road</i>	<i>Average cost per yard super per annum for three years previous to motor omnibus traffic (cents)</i>	<i>Cost per yard super for 1912-13 since the advent of motor omnibuses (cents)</i>
A	13.5	25.8
B	11.2	33.1
C	14.1	41.9
D	15.6	16.9
E	9.1	15.4
F	8.7	15.1
G	5.9	16.8
H	5.1	11.1
I	21.5	36.4
J	16.9	42.9
Average	12.3	25.6

This shows that the average cost of maintenance for three years before the motor bus came in was about 12 cents a square yard a year. Since the motor bus was put on the cost has increased to over 25 cents a square yard a year. The maintenance cost to carry one ton one mile in 1911-12 was 1.2 cents. When the motor bus was put on the maintenance cost was raised to 1.8 cents per ton per mile. Mr. Wakeland's opinion is that this increase was practically all due to the motor bus. The increased cost of the road up-keep has been found to be about four cents per car per mile, or two-thirds of a cent per ton per mile in the case of a motor bus on rubber tires. In many cases the macadam surface has been practically destroyed by motor bus traffic on hard rubber tires. These were macadam roads in good standard condition prior to the inauguration of the motor bus traffic and more than sufficient to carry the ordinary traffic. The road authorities should be authorized to direct which roads shall and which roads shall not be used by motor vehicles and motor buses, and Mr. Wakeland states, as do the other county engineers in England, that a license fee of \$50 a year for motor trucks is entirely insufficient to pay for the increased cost of maintenance caused by the use of the trucks on the roads.

CONCLUSION

A road means a highway that can be traveled over with reasonable convenience and with reasonable effort by ordinary vehicles. Two ruts and a horse track with six inches of mud and large pot-holes scattered frequently over its surface do not constitute a road.

A road to be a road worthy of the name must be constructed and maintained so that it will at all times satisfactorily and economically bear the traffic which passes over it.

Good drainage, foundation whenever necessary, and a top surface always maintained so that it will shed water, are necessary prerequisites. If any one of them is missing you do not have a good road. Constant maintenance is eternally necessary; drainage must be always open, and road surfaces must always be maintained. The most economical way to maintain a road is by constant maintenance.

With modern Massachusetts motor vehicle travel, a newly-built macadam road without any bituminous materials having been used on it, will easily be destroyed in one month, so far as its surface is concerned, and will be damaged so that it will require 15 to 25 cents a square yard to put it back into condition so that some bituminous material can be used.

Roads and road surfaces must bear the traffic that goes over them. The tables I have printed show conclusively how expensive it is if materials are not used and methods are not used with those materials, so that the road can withstand the traffic which goes over it.

I think by a study of the tables and our experience, you can gather, knowing the traffic on your road, what will probably be the most economical way to construct or reconstruct your road.

With a certain volume and weight of traffic, granite block on a concrete base will perhaps be the most economical, especially for heavy concentrated loads. Thirty-ton loads on four wheels are very common near the docks in Liverpool, where six-inch granite block on a concrete base has worn 18 years.

In figuring costs you must figure what the road has to bear in tons or otherwise. Speaking in round numbers, you will find on figuring the English roads and American roads that it costs about a cent a vehicle a mile per year to maintain the roads. It would not surprise me if the same were true on dirt roads. Dirt roads, of course, will not stand very much heavy teaming, no matter if they are kept constantly patched.

This money you must have and it must be properly expended if your original cost of construction is not to be lost and you are not to find yourself saddled with a debt on which you are constantly paying interest years after the road has passed away in dust.

But you must go further than that and figure what are the proper methods, proper materials, and the best and most economical surfaces. As I have shown, for merely automobile travel, cars on pneumatic tires, you can economically and satisfactorily maintain a gravel or macadam road in the summer season by the proper use of a good bitumen and constant maintenance and patching.

You can maintain a water-bound macadam road, if the traffic is not too heavy and by too heavy I mean too much teaming, by the same methods.

You can maintain a bituminous macadam road more economically than either of the above roads when the traffic in teams or trucks is so heavy that neither of the other roads are economical. With heavy concentrated roads that will crush or wear a trap-rock macadam say at the rate of from one-half-inch to an inch a year, water-bound macadam is not economical, either with or without a bituminous surface. Bituminous macadam will be much cheaper in the end. That is, of course, provided bituminous macadam can withstand the traffic that goes over it.

With a certain volume of traffic it is more economical to construct a pavement probably on a concrete base or possibly in some places a concrete road.

You will note that the increased cost on many water-bound macadam roads in England when the motor bus service was put on was substantially four cents a mile for every mile that the buses, which weighed six tons including their load, went over the road. Proportionately a small runabout would probably cost about a quarter of a cent; a large touring car from one to two cents, and probably a heavy horse-drawn vehicle with a three-ton load would cost about the same.

Constant maintenance costs money. Our labor costs are much in excess of those in France and England. Our materials probably average the same, though in Massachusetts our stone is cheaper than the French or English imported Belgium or Welsh granite, which is practically a hard trap-rock.

You will note that all the French roads, even little country roads, cost over \$100 a mile a year on the average to maintain. You will note that even the little country roads in England have cost more. You will note that the French engineers practically state that they need \$770 a mile for many miles of road on their main roads to adequately maintain them; that the English county engineers spent \$1100 a mile on the average on their main county roads, and that we in Massachusetts are spending \$850 a mile.

These figures, of course, include not only ordinary maintenance but resurfacing when say one-half of the original road surface has worn off.

The people must be made to realize that if the original investment in roads is not to be lost, adequate provision must be made for the maintenance of the roads, and the money secured from some source.

Remember that while

The Knights are dust
Their swords are rust
Their souls are with
The saints we trust

the bonds will be presented on Resurrection Day.

MR. SUGGS: It was not pertaining to the subject but I just want to know what is the benefit to be derived from this expenditure and what you get from your streets and what benefit they are in the State by reason of having these good roads? I have heard some great stories about the tourists leaving money in New England by reason of these good roads.

MR. SOHIER: Don't come into our State and think you will get away with any of your money. The tourists leave there, according to whether they stay at the Touraine in Boston or at Magnolia in Gloucester, Mass., or some of the country hotels, \$2.50 to \$10 a day, and they pay for their gasoline and \$1.00 to \$1.50 a day for their car. Unfortunately we don't get that money for the roads. If we did, we would keep good roads all over the State. We, in New England, have got the best summer industry that anybody has got in any part of the United States except in some parts of California, and we are glad they are all coming up there wearing our roads out and leaving us their money. There is a little country town in western Massachusetts that had a valuation of \$300,000. Our towns include the whole township and the town takes care of all the roads inside that township and collects both the State and county

tax as a part of the town tax. It is not a borough inside of a township, the roads are not maintained by the county; the county does not collect the tax except through the town. We maintain our own State highways. They started ten years ago improving their roads in that town. They borrowed the money; they put in at least \$500 and sometimes \$1000 a year and we have matched it under the State Aid Law and in the beginning we gave them all we could under the State Aid Law and with that money they got 10 miles of town highway built of gravel on a foundation where it was necessary. When they started the valuation of that town was \$300,000. A few men who had come into that town increased their valuation to nearly \$750,000; they have doubled the value of every acre of land on the main street and that town is appropriating some years 50 per cent of its taxes for road improvement because they say if we only can improve the roads and so increase the valuation that the schools can wait and they will have twice as much money for our schools in five years. We in Massachusetts have had town after town that has doubled its valuation within five years after the time the road was built. We have just opened up a road over the Mohawk Trail between Greenfield and North Adams and when some of the gentlemen telegraph and say, "What does it cost to build a macadam road per mile?" they'd better ask Brother MacDonald than myself. That road is nothing but a graded dirt road, poor dirt, some of it, and it is going to be maintained with a log drag. It is 16 miles long over a new location and it has cost us about \$350,000 for 16 miles, without any improved surface whatever; and it is built in three towns where the total valuation of the three towns is less than \$1,000,000; in other words we spent 33 per cent of all the valuation of those three towns to get a through road east and west in the northern part of Massachusetts, and there comes where I am willing to make a bet; I will make a bet that five years from now the valuation of the towns in that neighborhood, or on the line of that road, will have increased four times the cost of the road.

MR. G. L. BURGESS: So you are not burdened with the thought of losing money by building these good roads?

MR. SOHIER: Our Legislature sometimes has made a special appropriation directing us to build roads that we think we ought not to build.

MR. BURGESS: How much does this dirt road cost per mile?

MR. SOHIER: The cost on one-quarter mile section was at the rate of \$60,000 a mile for grading. There were 100,000 yards of earth that came down grading slides last winter. There's 75,000 yards of rock excavation on one side of the mountain; we did that at a cost of \$1.50 a yard.

MR. BURGESS: Our country is just a level country; we put up about a mile a day for about \$8 a day.

MR. SOHIER: You are very fortunate, sir.

MR. SWINDEL: We sent an engineer to your State in June to investigate some sand oil roads there as we called it. There is a little place in an adjoining county to us that has been built about a year and a half and it has got people in that county crazy about that class of road, and while we are in a day's ride by automobile of where the Indians are living in their native huts and we don't get any State aid, neither have we had but very little engineering aid in the roads in our State, we are not following the path of the calf that has been dead 200 years ago, and we want to know or would like to know if you could tell us anything about that asphalt oil sand road; I mean whether the sand is heated, whether the sand and asphalt are heated and mixed and put on the road hot, say, the road bed rolled and leveled off and that material put on and rolled down three or four inches thick, something like that. Do you know anything about the wearing qualities of that kind of road.

MR. SOHIER: I would be happy to send the gentleman the specifications. We built an asphalt oil sand road in 1906. It was built by what we call a layer method in a little town on Cape Cod where there was nothing but sand, the road surface was hardened with loam and clay. I think we had to use loam at that time, so that it would not rut much. On that we spread three-quarters of a gallon of hot asphaltic oil, and you can get better grades of oil today than we used then if you buy the good grades with an asphalt base, and you will have an absolute failure if you buy oil with a paraffine base. If you get Mexican oil, California oil or Texas oil from the right wells, you will usually get good oil. Three-quarters of a gallon of oil was spread per square yard, very roughly. That had about an inch to an inch and a quarter of sand put over it and another three-quarters of a gallon of oil was spread over that, then another inch or an inch and a quarter of sand spread on that, and then another one-half of a gallon of oil spread on that, then about an inch of sand put over that. That road cost at that point \$1700 a mile for a 16-foot road the first year.

Now the next spring you jumped from hump to hump, you thought you had no road and you had a lot of ruts and holes and it was very uneven. It was harrowed with a disc harrow; first broken with a gang plow, harrowed and made fine with a disc harrow. If we could have used water, we would have secured better results but we did not have any water. It was shaped back, rolled in and given a little more oil on the surface. It stood us \$2500 a mile the second year and we had a reasonably satisfactory road for 12 or 15 farm teams and light buggies a day and the road is on the job now and you

would not know it from some of the other roads made by a mixing process, but we have been constantly filling ruts and holes and it has cost us about \$300 a mile a year to keep that road up, but no more than the macadam road right alongside of it and the macadam road alongside of it is now getting 500 cars a day every pleasant day in the summer, and it is taking them and the old oil sand road is carrying the same.

The road by the mixing method costs usually about \$4500 a mile. You must get a good quality of oil, you must be sure your sand is dry and hot, about the same temperature as the oil. We are getting better results with a hot mixture. We did mix it by hand. We have had prices of 30 cents to 40 cents a square yard for the surface not including any grading or hardening the subgrade with clay or loam. We furnished oil to the contractor. That is for 4 inches thick and 16 feet in width, and on those roads we are finding it is rather better to give them a surface application of oil the first year because it is very hard to get the man who will either rake the mixture smooth or put down his shovel so that he does not get a little bit of a ripple.

The layer method costs \$2500 a mile and the mixing method about \$5000 for the surface.

The first method takes two years, sometimes three, before you get a good road. By the other method you get a good road almost at once. You ask how long are they going to last? They are going to last us ten years provided they do not suddenly develop such a heavy traffic of heavily loaded teams on iron tires that they cut through. They have not cut through yet, and we put them right against macadam all the way from Boston to Cape Cod, 150 miles, but with large automobile traffic, not heavy team traffic, and we are a little bit afraid of the auto trucks. We know that one truck a day won't hurt the road, or five trucks won't hurt it, because we use trucks over it ourselves, but they are rutting it a little. We hope it is not going to rut much and we hope if we have to do anything to it, we will find that we can roll stone in on hot days and thus strengthen the road and save the top. In the future we can perhaps grade out sands, use a better and harder asphalt to make practically a sheet asphalt road without too great an increase in cost.

MR. BURGESS: The road I mentioned was built in front of a hotel; the man is here in town that had charge of the construction, I don't remember his name now, but while the road won't get hot enough to run or puddle in hot weather, it is not perfectly hard, it is the least bit springy, you can take your knife and cut out a piece like that and stick it back in and rub your foot over it and in a little bit you can't tell where it is, it seems to go back together. Well that road was constructed by burning all the vegetable matter out of the sand, having nothing but the pure sand and heating the oil to something like 250 and mixing it hot and putting it on the road and rolling it hot. It was mixed by hand, just a small piece,

but we've got the road craze in our county; we've got sand up there that deep.

MR. SOHIER: So have we.

MR. BURGESS: And my Hillsboro County friend is building brick roads. We are not able to build brick roads; I don't know that they are much richer than we are, but there's more of them, so I don't think we could build brick. The only material we have is a reasonably poor class of clay and we are using a great deal of that with the sand but it goes all to pieces; it won't stand, and from the way that little piece of road looks down there and what our engineer reports he brought back from Cape Cod about that road up there, we have about decided that the sand asphalt road was our best road.

MR. SOHIER: Where do you come from?

MR. BURGESS: South Florida.

MR. SOHIER: I think if you have got really a hot climate, if I were in your place, I'd use the heavier oils, I would use some of the oils that you want to heat to 300 to 350; you can still make it mix if you will heat your sand to the same temperature.

REPRESENTATIVE OF THE STANDARD OIL COMPANY: The Standard Oil Company, of Jacksonville, will give him all the information he needs.

MR. BURGESS: The stuff we are using is about 99 per cent pure asphalt; it is not an oil at all, you can cut a chunk out of it, and throw it around anywhere you please and it won't run; but now, as you see, the granite road wears out, the brick wears out, the steel rails on the railroad wear out. If this sand-oil road, this asphalt road wears out, why can't we heat some more asphalt, sprinkle some sand over it, heat some more asphalt and sprinkle some more sand over it and build up that road and keep it from wearing out?

MR. SOHIER: That is just what we are doing.

MR. BURGESS: We have great quantities of sand; if we can get some plan by which we can build a road out of sand, we are fixed. We don't have to blast up the sand, we can shovel it out.

MR. SOHIER: You want to use the coarsest, best sand you have in the bank, and if you want to do it cheaply, you want to mix it by machine, and the next thing I want to say is this, you cannot use any specifications and find them correct on your particular sand,

we don't know enough yet to know why, but we do know that some sands apparently, as far as we can tell, the same, mix very nicely and come down with 18 gallons of oil, hot, to the cubic yard of sand; we use up to 23 on other sands and when you get your road done, you want to have your material well mixed so it will pack down and won't be mealy. It ought to tamp out so that it compacts. The rule for that is as it was with the tar, spread your sand in a heap and rake it and if you've got about the right mixture of sand and oil, it will continue to crawl for quite a few minutes after you have mixed it and it stops right off after you've raked it if you have not got enough, also when you tamp it or roll it there should be enough asphalt in the mixture to make it consolidate pretty well.

MR. BURGESS: Let me ask one question: I was at a little town nearby where I was putting down a small piece of street out of this same material and noticed a man that was putting it down; he took a little piece of paper and was mixing the sand and oil hot, had it hot before he put it together and still kept it in the same pot with a fire under it, and he would take out a little of that sand every few minutes and look at it on a piece of paper and I thought from his examination that he was trying to get it mixed until the grains practically become a part of the sand. It was mealy like; then he put it down and when he put it down and packed it a little it seemed to go together all right.

MR. SOHIER: What you need is just about 10 per cent more asphaltic oil than the voids in the sand as shown by water but we have not been able to use very heavy asphalt. We tried to mix sand and asphalt with the result that it rolled up like a snow ball—I am speaking of barrel asphalt that melted about 350—and we found that we could not use as heavy a material as that and consequently we have used the heaviest standard oil, what they call B and without very much difference since the Standard Oil Company has given us *Mexican oil*; we had some perfectly punk jobs before they gave us Mexican oils. We have used California and Texas oils and got good results and no doubt any good asphalt will give good results if you have the proper sand.

MR. BURGESS: I understand that the asphalt is just used to fill up the void between the sand, and when you get it packed you have practically got a sand road?

MR. SOHIER: Sheet asphalt has only about 10 per cent of asphalt in it. The Topeka mix has only about 10 per cent of the bituminous material in it as compared to the rest of the material as in the sheet asphalt and that is about 18 gallons to the cubic yard, but it swells one-seventh with the heat so that it would make 19½ hot.

MR. BURGESS: The specifications I think we have call for 18 gallons to a cubic yard of sand.

MR. SOHIER: I would like to say to any of the other gentlemen here that we have some of the best roads I think that are built anywhere, that are built by the same method exactly that I have been describing, using hot asphaltic oil with gravel, clean sandy gravel, grading that gravel and they are very much better than the sand roads because we think they will take any amount of travel. We use a good clean sharp gravel and they have been down 7 years and don't show a pimple yet.

A MEMBER: Is the sand on the Boston and Cape Cod road marine shell sand?

MR. SOHIER: It has no shell in it; we tried to get a coarse sand and not a fine sand; it is fairly sharp but it really has several sizes of sand; we get it out of the bank, don't take it off the beach. We have one place where we could take it off the beach but there it is an original sand bank which was originally marine sand but has been in the bank a great many years now. It is much sharper than the sand on the beach. The success of the road depends on the quality of the sand in my opinion. You should try experiments first and so find out if the sand and oil will work and what particular sand and particular oil will give the best results. Then use that.

REPRESENTATIVE OF STANDARD OIL COMPANY: If our Florida friend will write to Watertown, Florida, they have just put down that kind of a road there this summer and he will get information that will help him.

MR. SOHIER: I think there was some put down by the Lane Construction Company a little south of Tampa this year, also.

MR. SWINDEL: That road you put the oil on was clay, hard surface, it was not sand like we have in Florida.

MR. SOHIER: It's just the same, sir, if your sand is coarse and sharp. All we use the clay or loam for is just enough in the sub-base so that when we spray the oil on and when the oil team goes on to the road, it won't rut it as deep as it used to rut the sand. When we sent an oil team over the old sand roads it took four or five horses to drag it with the result that when you looked at the road you found a whole lot of oil in the rut and a whole lot in each horse's track and got little drop of oil all over the rest of the road. All this had to be harrowed and broken up and mixed and rolled back to get a road. Now after we have hardened the road we can spray

three-quarters of a gallon of oil to the square yard and have it very even and I have seen a road with only one coat of oil that stood the traffic for quite a little while very nicely.

MR. SWINDEL: Do you have a heater in your tank to heat the oil?

MR. SOHIER: Sometimes, but we usually heat it to 275 in the tank car so it spreads about 250 on the road and we also use a pump so that we can get on three or four loads a day and in that way save quite a lot of money. If you can get good clean sandy gravel so that you can use inch and a half stone graded down to clean sharp sand, you will get a road that I think will wear as well as asphalt pavements under country traffic.

A MEMBER: May I ask what is the heaviest steel wire traffic that goes over the Cape Cod road?

MR. SOHIER: The heaviest probably is 3 tons, but there are very few of them. The ordinary traffic is the little country traffic that farmers and fishermen have around there and most of them are single horse wagons. If you will write me, I will send you the traffic on that road, exactly what it is.

MR. SWINDEL: We are going to build a quarter of a mile in each commissioner's district in our county, of this asphalt sand road and scatter it in different places over the county so that the people of the county can see it, and of course it will be built on different classes of ground you know and it will be subjected to different kinds of traffic and we are going to put in a quarter of a mile in each commissioner's district, just for a test to see how it will look.

MR. SOHIER: Build it 16 or 18 feet wide, otherwise they will cut in on it, and crown it one-third of an inch to the foot, only and not more—three-quarters of an inch to the foot always makes a rut, because every one straddles the crown.

MR. SWINDEL: The clay has been put down and it has rutted out, knocked into holes. We thought to level that off and put this material on top of that.

MR. SOHIER: I don't think you can mix it with any sand that has clay in it, 5 per cent clay in the sand will spoil your mix.

THE CHAIRMAN: Are there any more questions that you gentlemen would like to ask?

A MEMBER: I would like to ask Mr. Sohier what kind of asphalt he uses with that gravel road, whether it is a penetration or mixing method of surface?

MR. SOHIER: We have a lot of gravel roads, have had oil surfaces on the gravel for some time and they work well. That gravel mixed road is put on hot, an inch and a half, stone in the gravel about 50 per cent stone down to a 100 mesh sand, and in one case where we were using broken stone on the bottom, we used the stone dust and considered it rather better than the sand, but we had to go up as high as 23 gallons of oil in one pit and 20 gallons in the other to get exactly the same mixture, and we use mostly a heavy grade of California oil, also some Texas, some Aztec, some Montezuma and some Standard oil right alongside, but just in short sections to see whether they were or were not what they were sold to be. Some are not. By and by we will tell you.

A MEMBER: Did those oils show any percentage of paraffine?

MR. SOHIER: No sir. Our specifications do not allow any paraffine, but I do think there is quite a difference in oils of the same specific gravity, in the way in which they will last without crawling at the end of three or four years. I think the cut-back, taking the top and bottom and getting the asphalt, is less likely to crawl than an oil that is refined down to a certain point, leaving the various oils in between the top and the bottom, but I think the thing we all know the least about, despite anything the Standard oil people or any other oil people will tell you, or anybody else, is bitumen, and if you get bitumen that will stick to your finger and put a pencil in it and can't take it off without cutting off the wood, you are getting a pretty good bitumen; and if you can wipe it off with a paper, you can bet your bottom dollar it is a lubricant and not good for road purposes. If it is long and stringy it is good; if it will stick to your finger or a pencil it is good, and if it won't stick it is not worth a cent.

THE CHAIRMAN: Are there any more questions? We have spent a very profitable afternoon and I want to say that I am very grateful to you for the interest you have shown. I hope that you will all be here promptly at 10 o'clock tomorrow morning.

November 12, 10 A.M.

GENERAL WM. T. ROSSELL IN THE CHAIR

THE CHAIRMAN: Gentlemen, the meeting will please come to order. I have here a notice to be published, that State and Federal highway officials and ex-officials will meet at 3 p.m. in the moving picture room. This does not apply to other than State and Federal officials. We have some telegrams that the Secretary will read.

THE SECRETARY: I have here a telegram addressed to the Secretary of the Road Congress which reads as follows: "The United Daughters of the Confederacy, 100,000 strong with chapters in 34 States of the Union, ask that the Great Highway to be projected through the South from Richmond to Santiago be named The Jefferson-Davis Highway, in which case they pledge their support to the same.—Mrs. Walter D. Lamar."

We have also another telegram reading as follows: Regret exceedingly unexpected business arrangements prevented my being in Atlanta this week," Mr. Paul D. Sargent, State Highway Engineer of Maine. I want also to announce that the annual meeting of the American Highway Association for the election of officers and for the transaction of such other business as may properly come before it, will be held in this room tonight at 8 o'clock.

THE CHAIRMAN: The first thing on the program is an address by Mr. C. J. Bennett, State Highway Commissioner of Connecticut on System in Road Management.

SYSTEM IN ROAD MANAGEMENT

CHARLES J. BENNETT

Highway Commissioner of Connecticut

In consideration of a topic of this character, it must be realized that there are certain principles to be applied in organizing or systematizing a highway department, which can be applied generally to the problem wherever a department of this character is to be formed. Further than that, we cannot go. The particular methods of accounting, the minutiae, the forms, types of books, methods of reporting and recording reports are in every instance a peculiar problem to be solved locally and in the manner best fitted to give a solution of the peculiar difficulties which arise on account of position and magnitude of the department geographically or financially.

Having in mind, therefore, that the detailed phases of the problem are local, there will be no endeavor in this paper to outline an ideal

system of accounting, reports and records for a highway department, for such a system would apply probably only to that particular department with which the writer is more nearly familiar. There will be, however, an attempt made to show in a general way, what, in the estimation of the writer, are the broad principles which can be applied to systematic management of a highway department, whether it be town, city or state.

In the first place, it is necessary to realize that there are two results to be secured:

First, the proper and economical spending of a certain amount of money in the way best fitted to serve the general public, and

Second, the presentation of the method of spending this money to the public, so that it may be thoroughly informed as to how its money has been apportioned and what results have been reached. Such a record or report made to the public should be in simple language so that the most uninformed may understand the results desired and the ends achieved.

In connection with the first proposition, i.e., the spending of money to get the best results. The first requisite in organizing a system of this kind is the record or system of bookkeeping which should show at all times, the condition of the accounts and keep a check on the expenditures made for specific purposes. Such a system should be simple and familiar to all the employees of the department and should show graphically, at a glance, the amount of the appropriations made for specific purposes and a summary of the definite projects on which this money should be expended with the total weekly or monthly expenditures for the purposes defined. This information should be available to all the employees and should be so plain as to make it possible for a change in the personnel of the office force without a consequent confusion arising from a complicated and abstruse system of accounts.

In connection with this system of bookkeeping and system of reports of work necessary, the orders for the work to be done should be immediately compiled and entered in the books so that the disbursements may be kept up to date. There should be no possibility of verbal orders which would call for expenditures of money without an accompanying written report and order, which should be entered at once in the ledger. This system of accounts should provide also for a periodic statement of the financial condition of the department, which statement or balance should show not only the cash available, but also the actual amount available after all the liabilities, bills and debts of the department were paid.

Having formulated such a system of accounting, a force of employees should be organized in such a manner that the system of accounts may be followed and in such a way also that the general idea of spending the money economically and well be firmly established.

The first idea which should be applied in the organization of a

highway department is the military system, that is, the department should be subdivided so that each part might have certain duties with a definite amount of money to spend. Each subdivision should report directly to the superior officer and through this superior officer to the military head. The organization should be such that no orders should be passed around a subordinate, but should rather go through a subordinate. It is quite necessary in dealing with a force of any magnitude that the rank and file should know the purpose of the organization and the wishes of the chief. In other words, the department should be imbued with the spirit and aims of the man at the head, for in this way each man will work, so far as is possible, along the same lines and the results gained will be more nearly uniform and standard.

An effort should be made to build up patriotism in the department, which should work for the betterment of the road system rather than for the personal benefit of the employees or of the political party which is responsible for the appointment of members of the department. A modified civil service system is a good thing, in that it makes the men more sure of their positions than under a political system. Such a civil service should, however, provide for the removal of employees by the head of the department without applying to any outside body, such as a State or Municipal Civil Service Commission. The whole idea of such a department and the organization of the force, should be to secure the right men for the right places and keep them there while they give good service. There is nothing which can disorganize a department so much as the right of an employee to apply to some outside body which has no knowledge of conditions and which can only judge of a man's ability or his right to hold a position, by an examination on his technical knowledge or by a brief hearing. The measure of a man's value is in the results he gains in actual service and knowledge of a man's ability can only be secured by the record of his achievements from day to day.

In the organization of a force, a chart should be prepared showing the connection between employees, showing to whom an employee should report and stating distinctly what his duties shall be. The best results are to be gained by delegating authority to a man and placing confidence in him, having in mind the theory that men are by nature honest and will endeavor to do right and gain good results if given the opportunity. Allowance should be made for honest mistakes and a careful record kept of such mistakes so that a man may realize, when removed, that the reasons for his removal are sound and based on results showing his lack of ability.

In selecting employees to deal with the public, men should be sought who are tactful, intelligent and polite in their intercourse with people. The employee should be instructed that at all times it is necessary for him to be fair and reasonable and to keep his temper. A public employee is a servant of the public and in his dealings with citizens,

should realize this fact, but he should also be firm and not afraid to refuse an unreasonable request.

Given then a system of accounting in the organization, the members of this organization must bear in mind that if they are kept informed as to the purpose of the department in which they work, they should on their part, keep their superiors well informed of their own movements, the amount of work done and the character and cost thereof. In other words, a method of reporting work should be established and kept which should give plainly and simply, all the necessary information as to the actual physical operations carried on by the employees. The local situation will govern the extent and frequency of such reports but they should show primarily and in a clear way, the work which the employee is trying to do, the probable cost of the work to be done before it is started, and from time to time the actual cost; including remarks as to the success or failure of any particular experiment. There should not be an endeavor to make complicated reports which should show minutiae to the point of the ludicrous, for a system of reporting which becomes so complicated that it is not simple of understanding, fails utterly in its purpose.

The recording of reports in connection with the accounting system should be made in such a manner that through these records the outsider, either layman or professional, may secure information as to the comparative cost of certain classes of work, the success or failure of certain types of roads and the financial value of expenditures for certain specific purposes. For instance, it might be possible to demonstrate in a certain instance, by a system of records that a larger first cost of construction would be very much more economical eventually than a small first cost with a corresponding large charge for maintenance in future years. The system of records should, therefore, show the ultimate result from an expenditure, which ultimate result should be gained from records made over a long term.

The above discussion has covered mainly the first principle, which was stated, namely, the endeavor to get good work with the money appropriated.

A road department has, however, the duty of presenting its operations to the public eye, not only as results on the roads themselves, but in the success or failure of the department as a financial proposition. This presentation must be made in the form of a periodical report to some superior body, as the mayor of a city or the legislature of a State. The writer finds, in perusing many of the reports made, that there is an entire lack of system in presenting the information, and no effort made to make the report clear. Most reports are made in such a manner that an expert accountant would be needed to find out results gained and even then, these results would be of little value. The spirit shown most in reports is that they claim general excellence for the department and try to justify its continuance. Certainly there are some failures made by roadbuilders, which

should be reported for the good of the work. Reasons for failure should be stated, whether the failures be financial or physical.

It is quite possible and necessary to make an annual report which is readable and interesting to the layman. The text portion of such a report should be written in plain English without technical terms and with general results stated broadly and succinctly. Tabulation of records should be made as simply as possible and the cost per unit should give, not only definite figures, but should state furthermore, just what details were included in the units of work done. For instance, in one locality maintenance of roads does not include the oiling of the surface, while in other reports, this oiling is included, which, of course, makes it impossible to compare the two costs, and for this reason, and many others, as stated above, the reports should show definitely what details are included under each heading, and the cost might be analyzed accordingly.

The above is designed to open up a general discussion on the value of system in road management.

The writer wishes to make clear again that there is no question in his mind that the system should be simple and operative rather than complicated and unwieldy. The simpler the method of bookkeeping, organization, reporting and recording, the more successful will be the results in spending the money economically and well and the more successful will be the opportunity of the official at the head to present his information so that it will be of benefit first, to the general public, and, second, to the profession of which he is a member.

THE CHAIRMAN: Mr. Paul D. Sargent was to have opened the the discussion on this paper, but as he is absent, the subject is open for general discussion.

MR. T. HUGH BOORMAN (of New York): I trust that all our meetings will have some practical result. I believe in work and not too much wind. There is one most important feature in Mr. Bennett's address which every man here and every association connected with us should endeavor to have carried out and that is the most necessary method of conducting the business of the Highway Bureaus, of positively discharging any employee who is not worthy of filling his position. I go back to the time of our worthy chairman's predecessor, General Newnan. When he came to New York we were inflicted, as another gentleman of the corps, General Benham, was inflicted, with these awful civil service employees. General Benham threw up his job because he had such a lot of utterly indifferent, inefficient men whom he had to employ. Now we should in every way endeavor to get ordinances or laws that the administration of the Bureau of Highways should be positively in the hands of one chief without any recourse whatever. Any man decided by that chief to be inefficient should be instantly discharged. You had

occasion recently in Philadelphia, in regard to licensing of engineers, to bring forward that statement, but while we believe to a certain extent in civil service, we suffer more from it than from any other source.

MR. KING (of Memphis, Tenn.): This is a part of the program, gentlemen, that I am very much interested in. We have in Shelby County, Tennessee, a commission form of government, as well as that form for the city, and I happen to be connected with the county government as chairman of that commission. We had some old method of conducting the public funds and it took us quite a good while to get rid of that system and I find, as an economic proposition that there is nothing so very advantageous to the management of your public funds and bridge building and road building as a public system of accounting, as well as a perfect system of purchasing. Everybody had been purchasing, even down to the lowest man in the employ of the county, whatever he needed, but that is not so now. One man who was handed down to me for political reasons, when I said to him—at the head of the bridge department—"You must come through my office for everything you want," got mad and said, "I have lived in this city all my life and in this county, and I never had to get an order for anything in my life; my word has always been taken." I said to him, "You can either adopt this system or quit." The result is that in the bridge department we have saved 47 per cent in one year's time by having a perfect system for purchasing. We have a road department and on my desk every morning there is a card from the foreman of every bridge crew, a card from the foreman of every dirt road crew, a card from the foreman of every turnpike crew, stating exactly what work was done the day before. For instance, if it is a bridge crew, they state exactly the bridge that was being repaired or rebuilt, where the lumber came from, how much old lumber was used and how much was thrown away, and from the dirt road department, how many miles of road work the day before, or fractional parts of a mile, were constructed, how many men employed and how many mules were in commission and how many out of commission, and from the turnpike department, the same way; so on my desk every morning I have a report from every man and at the end of the month I can tell whether one man in the dirt road department is costing me more than for other crews of like character and like equipment; I can tell the same way in the bridge department what it costs per foot or per hundred feet to work that lumber; so then it is an absolute system and that system is reducing the cost of repairing and building in that county from 25 per cent to 47 per cent. So gentlemen, there is not anything that so concerns us and the taxpayers of this country, there is not anything so pleasing to the taxpayers as the very question that the gentleman has been discussing and I think we need to study it and get a system all over this country that shall be workable and plain, that the people may understand.

MR. J. W. BARNETT: The gentleman has just outlined in a very clear and interesting manner his method of record keeping, cost keeping; he stated that before any supplies could be purchased that orders would have to be issued. I would like very much to have him explain to us his method of purchasing supplies, whether through a purchasing agent or whether it is done through the chairman of the commission; that to me is a very interesting point.

MR. KING: I do the purchasing myself, as chairman of that commission. Every dollar's worth of goods of the county, amounting to \$7000 or \$8000 a year, I purchase myself.

MR. E. P. BALA (of Atlanta, Ga.): Order is the first law of nature. God in making the world had a plan. Everything must have its plan to reach perfection. In road building as in everything else, there must be system. If you want a road, the first question is, is it a public utility? Is there traffic enough to justify that road? How is it to be built between two points, and you must get a doctor. An engineer is a doctor of highway roads. You must employ a competent engineer. He must go over the road carefully in a preliminary survey. If I was going to build a railroad or a highway from Atlanta to Macon I would want to know the difference of elevation between those two points; I don't want to crawl up higher than Atlanta a dozen times. In going from Atlanta to Macon I want to go by a uniform down grade because Macon is lower than Atlanta. The location of a road is an important consideration; you don't want to sacrifice grade to curvature or curvature to grade, but you want to find out which way the main traffic will go when this road is built, and want to build with reference to grades, and the way the traffic is moving. You want to put as few curves as possible and get as near an airline as possible and put no heavy grades upon this road. If you put curves, pursue the same policy the railroads do, make circle curves going from a tangent to an easy curve or a little higher, and then to the body of the curve, and all in the same way. Another thing, you want to prepare to procure the right of way before you strike a lick in excavation, you want to be sure that you get a wide enough right of way for all the purposes that road will be put to, put it a little wider than the present necessities call for, give it ample room, and whenever you strike a curve you should have the right of the property from each end of the curve and clear that right of all trees to give access to sight; put no dead men's curves on it. Then again, after your location is made, be sure you get an engineer that is capable of carrying out the instructions on this road, give him some limit, give him the idea of thought; don't grind him down by conventionalities. I was once called upon to locate a line from Chicago Junction to Chicago. My instructions were the simplest ever had—"as near an airline as possible, pay no attention to towns, we are building it for a freight line." Those

were simple instructions. The engineer was on his mettle and we got 271 miles out of 269, all roads crossing either under or above, for safety. It's the same way with our roads here; when you hit a railroad, if possible, go under or go above. Then the next question in road building is the surface; get a good cross section and maintain it, and if your traffic is very heavy, put on the best material you can find, using economy; and again you want to keep that surface up to its original character. If a sharp tired wagon goes over it and cuts it, you want to be there the next moment and hammer it deeper and so on; heavy traffic comes along and makes a terrible hole, one that is dangerous to the public. Then again you want to have system in everything, system in keeping accounts, system and a head to every department. This thing of every man being a head is all wrong; there must be one head. A man that cannot do his duty under any circumstances does not deserve the position that he holds.

THE CHAIRMAN: I received this notice:

The following resolutions were unanimously adopted by the Georgia Women's Suffrage League, Mrs. Francis Smith Whiteside, President, at their meeting Wednesday afternoon:

Resolved, That the Georgia Women's Suffrage League heartily endorses the movement of the American Highway Association for good roads in Georgia and that the League stands ready to coöperate with the movement in all their undertakings.

Next on the program list is a paper on "Street Construction and Maintenance," by Henry W. Durham, Chief Engineer of Highways, Manhattan, New York.

SOME PROBLEMS OF STREET CONSTRUCTION AND MAINTENANCE AT HOME AND ABROAD.

HENRY WELLES DURHAM

Chief Engineer of Highways, Manhattan, New York City

When recently the invitation was received by me to discuss the subject of street construction and maintenance, it seemed like asking for the writing of a cyclopoedia in two weeks. Most books bearing this title are at best merely superficial and all that can be said in a few minutes, is to touch on a few points which may have a passing interest to those, who like the speaker find the attempt to satisfy public demands, always hampered by a general public ignorance even among those considered well informed, as to what is the best or the standard practice in other communities than their own, as well as to why many conditions about which complaint is made, cannot be immediately changed.

It must be recognized that the problems of our largest city as a whole, are not always those of others of a lesser size, but usually some of its subdivisions can be found to parallel almost any other municipality, the Metropolitan District having grown by the consolidation of former distinct units varying from villages to large cities, many of which still continue their individual characters.

Any tendency on the part of the speaker attributable to the alleged insularity of New York, may possibly have been modified by beginning his paving career as engineer of our oldest American city, Panama, and by a course of investigation of municipal paving conditions, both in European cities and in those of our country.

Some years since, in a report made by a citizens' committee on New York pavements, expression was given to a popular idea which still prevails that the pavements of the City of New York are, and probably always have been, very inferior to those of first-class cities of the old world. As the facilitation of public communication by its highways gives as good a measure as is possible of the prosperity of a community, a short statement of some European and American street problems and the methods of solution employed, will be of more interest than purely local statistics, even though now progress in the cities of the former continent, may be temporarily interrupted; because the duration of that interruption and its ultimate result may, to a great extent, depend on the degree of perfection attained in highway communication in the various countries involved.

The work of pavement maintenance abroad, has been largely dropped for the present as is witnessed by a recent communication from the director of the French Mission of Engineers to the United States of America, now in Paris, who writes me regarding his inability to furnish certain data which had previously been requested, due to the fact that he "is becoming more and more busy in quite different lines." This censored bulletin seems to indicate that the famous corps of Engineers of Bridges and Highways is not at present occupied with its ordinary civilian problems.

The statement may be axiomatic, but it still seems to require reassertion that though road construction and maintenance have been from the earliest times to the present of primary importance to all countries that have attained important rank, they have radically altered in conditions in the past quarter century due principally to two causes: the first of which is the motor vehicle; and the second (in so far as relates to the problem of municipalities) the increasing importance of utilizing the space immediately beneath the surface of the streets for public utilities. These are required to an extent increasing as rapidly as the density of population in working, trade and residence centers, which involve a demand for the distribution of power as well as for means of communication and transportation requiring large installations of lines for telegraph, telephone, water supply, gas, sewers and rapid transit railroads.

City streets developed from first being that portion of a highway between built-up rows of houses and the adjacent communicating spaces between outlying buildings, and were gradually, after many centuries, elaborated by the separation of pedestrians from vehicular traffic. Up to the middle of the past century a pavement, consisting of stone blocks laid directly on the ground surface of the street, was considered satisfactory in all cities of Europe and in the older cities of this country. At the present time such a surface is used in a great part of the streets in every important European city.

An essential difference between our cities and those of Europe lies in the fact that, due to our broad growth, our streets are to a very large extent on regraded ground, whereas in many of the older cities of Europe the streets have occupied their present location for hundreds of years, have been only to a slight extent excavated and re-filled, and furnish a durable unyielding foundation for the paved surface. It is safe to say that not 10 per cent of the area of streets of the great cities of Europe are paved on a concrete foundation, a notable case in point being the city of Hamburg where some of the finest stone pavements in the world, having flat heads and close fitting joints, are laid directly on a sand foundation, and Paris, which has $\frac{1}{11}$ th of its stone streets on concrete. But whereas most European streets of whatever type have a permanent surface suitable to the existing conditions, those in our cities not yet provided with a concrete base are largely of a temporary and unsatisfactory nature, awaiting permanent improvement.

For new pavements in important thoroughfares concrete foundations are regarded as essential by engineers on both sides of the ocean. As to the requisite thickness and proportioning of the concrete there are as many practices followed as there are cities. The minimum thickness abroad, and a figure which corresponds to that of many of our important towns, is 4 inches. This, up to July of this year, was regarded as adequate in Brussels for the traffic previously contemplated. Probably the average abroad is about 6 inches. Berlin and Paris have foundations running from 6 to 8 inches as do Liverpool and Birmingham, while London goes to a maximum of 12 inches on its main streets founded on an alluvial soil.

Its composition in different places varies between wide limits. A cheap and easy form of criticism occasionally indulged in by those well enough informed to know better, is to direct public complaint against some specified case of foundation concrete work in New York, often based on the authority of some eminent engineer (name not given) who observed the work on his way through the street and stated that the amount of cement employed was inadequate and the materials not properly mixed to produce a durable foundation. On such criticisms argument has been based that the proportioning of such concrete in Manhattan at the ratio of one of cement to three of sand and six of stone or gravel does not produce a strong enough mixture.

For purposes of comparison the following table shows some of the varying proportions abroad:

	<i>Cement</i>	<i>Fine Aggregate</i>	<i>Coarse Aggregate</i>
London:			
City and Westminster	1	6 Thames ballast—unscreened river gravel
Lewisham	1	7 Thames ballast—unscreened river gravel
Battersea	1	3 sand	5 clean gravel
Liverpool	1	6 crushed slag	3 broken stone, 3-inch gauge
Paris	1	3½ sand	7½ stone or gravel
Berlin and Charlottenburg	1	8 fine gravel and sand
Hamburg	1	7 unscreened river gravel
Vienna	1	3 sand	5 gravel

First quality cement is the same on both sides of the ocean, but it should be noted that, except in the best work, in the continental cities the contractor is usually permitted to use on streets of secondary importance a slag cement of inferior grade and in some cases a lime mortar, so that the concrete would be of much less strength than the proportions indicate. It is frequently constructed of bank gravel, no separate measurement of sand and gravel being made, but the proportion of cement added to the run of the bank. Often the old macadam road material is used, when a street is repaved with an impervious surface, to furnish the material for concrete, it being screened at the side and mixed with cement and sand.

Work of concrete mixing is done almost entirely by hand, although machinery has been introduced in Germany to a small extent. The subfoundation is rough graded with about the same accuracy prevalent in New York, but it is more usual to finish the concrete surface smooth. It is commonly laid between forms set transversely to the axis of the street at intervals of about 15 feet, materials being turned over on a mixing board between these forms directly into place. Final finish to the surface is then obtained by drawing a straight-edge across the width of the street, the concrete being laid mixed wet enough so that finer material flushes to the surface and produces a fairly smooth finish under the straight-edge. Where this method is not followed, the forms are placed longitudinally and a finish obtained by drawing along them a template formed to the proper transverse section. Where wood pavement is to be laid, particular attention is given to obtaining an accurate smooth surface and a certain amount of hand-smoothing is sometimes employed; but it was noted in London and in other cities that by employing the method of accurately setting transverse strips to the surface grade on narrow widths of concrete and then drawing a straight-edge or a screed along on these adjacent strips, between which the work of mixing and placing was being carried on, a sufficiently smooth surface was obtained with very little subsequent plastering. For asphalt and granite it is not attempted to obtain such smooth

results, but usually a more accurate surface results on all classes of work than with us, though it is at the sacrifice of speed. The quality of the concrete is not superior to that now being produced in this country.

In summary it may be said that Europe presents to us no solution of the pavement foundation problem different from or better than those known in this country, and that there is substantial accord in all important cities about the present-day necessity of concrete foundations for durable pavements.

A most difficult problem confronting the highway engineer today in city work is to make a correct decision as to a suitable form of wearing surface to be adopted, one that shall if possible combine the very contradictory qualities demanded by the different interests involved. Horsedrawn trucking interests, which are still with us to a great extent, desire a surface which shall furnish a good foothold for animals in addition to giving good traction for wheels; the occupants of adjacent buildings desire absence of noise and cleanliness; while the necessities for access to subsurface structures require the possibilities of frequent opening and easy restoration to a condition substantially as good as the original; further, the taxpayer demands a form of construction that shall combine a minimum of original cost and subsequent maintenance with a maximum of durability; and the general critic calls for the discovery of some hitherto unknown perfect type and refers us to the great cities of Europe in which, as he knows from personal observation during the few hours he spent in each and on the few blocks which he visited, the pavements are perfect, repairs never required, openings made during the night and restored before morning—all at practically no expense to the taxpayer.

Investigation does not bear out these claims, nor unfortunately does it discover the desired solution. The municipal highway engineer everywhere abroad, as in this country, is trying to satisfy the same conditions with the same limited success. The best to be said is that general experience has reduced to a very few classes the number of desirable wearing surfaces for city streets, and the selection of the most suitable for each particular case is usually arrived at by a process of elimination, taking the one that presents the fewest drawbacks.

The original street pavement, and that which is used over more than half the area of all city streets in Europe at the present time, is some class of stone block, ranging in quality from the rough cobblestone pavement which has been generally discarded in our cities but which is still very prevalent abroad, through various grades of squared block to one laid with hand-dressed blocks with joints of less than $\frac{1}{4}$ inch and heads absolutely plain, found to a very limited extent in such cities as London, Liverpool and Birmingham and costing from \$5 to \$10 per square yard.

The most frequently used type at the present time in the cities of

Central Europe is that known as the Belgian block from its prevalence in that country—a type superseded with us; but when laid with the greater care usually found abroad and on streets little subject to excavation, quite satisfactory though noisy. These blocks are generally laid without foundation, with joints not exceeding one inch in width and a surface much smoother than that of our poorer type of similarly paved streets.

Another variation of this class is the type of large slab block pavement employed in Italy and, to some extent, in Austria, composed of stones measuring sometimes as much as 18 x 24 inches on the top with a depth of about 6 inches, laid with close-fitting joints and combining wearing surface with foundations. Such pavements, while extremely slippery even when the upper surface of the block is grooved, seem to give entire satisfaction in the cities where they exist. The material employed for the block is, as with us, either a trap rock or a granite presenting varying degrees of hardness in accordance with the material available for the locality in question. Only in exceptional cases is there any attempt made to classify the stone according to hardness for use on grades of various steepness.

The latest improvement in stone paved streets, and one occurring simultaneously on both sides of the ocean, is the reduction of the depth of the blocks over a concrete foundation to a dimension not exceeding 5 or 6 inches, and the use of accurately cut square-fitting stones laid over the foundation in a cushion of minimum thickness in virtual contact, so that when the joints are solidly filled with either a cement grout or some bituminous material they shall present no edges to wear round and produce an irregular noisy surface under traffic.

In most European city streets where none of the above kinds of stone pavement prevail, some form of macadam or Telford roadway is used, either the old water-bound surface or, in the more modern construction, with the addition of a bituminous filler.

Finally, on a limited proportion of the better class streets, and these are in the area commonly seen by the tourist, there are found the quiet and smooth surfaces—sheet rock asphalt and, to a lesser extent, soft or hard wood block.

Making a comparison with those of our American cities which have devoted much attention to modern repaving in recent years, it would seem as if the above classification should be reversed both as to quantity and quality; but it is based on accurate figures for the leading countries of Europe. A tabulation of the relative quantities of different classes of pavement in the first seventy-six cities of Germany shows this to be the case. The list includes all cities having a population of 50,000 and upward or an aggregate of more than 15,000,000, which is nearly one-fourth of the entire country. They have a total area of paved carriageway of approximately 110,000,000 square yards divided as follows:

Stone block, all classes.....	60,000,000
Macadam, telford, gravel or earth.....	35,000,000
Asphalt.....	9,000,000
Slag block.....	2,000,000
Wood block.....	1,000,000
Small cube stone.....	2,000,000
Miscellaneous.....	2,000,000
Total.....	111,000,000

That is, more than 50 per cent is stone block and 86 per cent either stone block, some form of crushed stone or dirt, leaving 14 per cent to divide among all other types. Of this remainder nearly two-thirds are sheet asphalt, and all other kinds occur in only relatively small quantities. These figures are from the official report of 1912 and consequently subject to slight revision, but show substantially the relative importance attached on the continent of Europe to the various classes of pavement surface. A statement of these facts does not in any way detract from a recognition of the large extent of elsewhere unequalled wood surfaced streets in London, nor of the very fine asphalt pavements in the newer parts of Berlin and on the boulevards of Paris and Vienna. Citizens of none of our leading American cities would be contented to have in a residential street macadam and stone block, to the extent to which they prevail abroad; and, consequently, lessons drawn from foreign practice are valueless to us in this respect, while we have already learned to construct stone and asphalt pavements of a quality equal to their best.

The selection of the types of pavement to be adopted in a great city, while limited in a large degree to the three classes referred to, can not be laid down in any set of rules whose observation will lead to the satisfaction of any community. Local climatic conditions, economically available sources of supply, as well as the relation to each other of the different localities for commerce, manufacture and residence and, finally, the financial resources of each city must all exercise too great an influence to make the practice of one valuable as more than a general example for another.

With regard to noise, more attention is paid to this question in city streets than previously, and the old type of wide joint stone pavement has been completely ruled out. On our modern granite streets such noise has been very measurably reduced. Motor vehicles are as quiet on them as on asphalt or wood, but there is inevitably a certain amount of rumbling from steel tires and horses' hoofs, and if the most noiseless surface is desired wood must be adopted. In view of its greater life, however, and consequent ultimate economy, its lessened slipperiness and almost equal ease for maintaining in a clean condition, the lessened amount of repairs required and the fact that it is the only surface in which street openings can be restored to a condition equal to the original, modern smooth-dressed close-fitting granite pavement on a concrete foundation, its joints filled with bituminous material, has been decided to be most satis-

factory for those streets in the borough of Manhattan having the heaviest traffic where the general city noises from surface and elevated railroads and the other sources of disturbance of a city render any condition attributable to variations in the type of pavement negligible.

For a fairly heavy and dense traffic in wide street subject to infrequent cuts and having a level surface or only moderate grade, there is no question but wood pavements can be laid that are eminently satisfactory. They require the most careful attention for maintenance and perhaps vary in quality between greater extremes than any other type. Nothing finer in the world in pavement surface exists than can be seen in London on the Mall from the Admiralty Arch to Buckingham Palace, a street that is subject to a fairly dense pleasure traffic, or on Whitehall, the Strand, Piccadilly, or many other of the adjacent streets in the heart of Westminster. On the other hand, some of the worst wood surfaces encountered in any city can be found within two or three miles of those just referred to, illustrating very clearly the absolute necessity of constant attention for maintenance and the selection of the best class of wood and workmanship for this type of construction.

For the combination of economy, cleanliness, absence from much noise and satisfactory surface for the general city traffic in the residence district, nothing has been developed better than the modern asphalt pavement. It has been adopted on a majority of the streets in New York City. While many miles of inferior pavement of this type have been laid there, all of a period long past, they are as rapidly as possible being superseded with a modern type of construction on a concrete foundation, which promises much greater durability and ease of maintenance. The relative lesser amount of this surface in European cities is very largely due to the fact that we have had no good pavements on any but a few streets in each city up to very recently; whereas it has been the practice abroad for many years to construct good macadam surfaces in all residence districts. At the present time foreign cities are following our custom of laying this class of pavement on new light traffic streets, and in the large real estate developments around Berlin asphalt was adopted almost exclusively. The cities of Paris and Vienna last year made contracts for extensive repaving with asphalt, which was being substituted in Vienna for the old stone surfacing of the Boulevard; while Paris was tearing out many miles of stone block, inferior wood and macadam and relaying with asphalt. This work will undoubtedly be resumed in all these cities when it is again possible to devote attention to rebuilding.

Much more difficult in our country than the writing of specifications appears to be the securing of the desired result. A strong difference seems to exist between our practice and that of Europe in this matter. A careful comparison of foreign methods with ours brings out very strongly the greater care given by us to the prepa-

ration of exact specifications and the greater attention given by them to the producing of the result for which the specifications were written. It would seem as if some of our city engineers thought that the whole aim of their office had been attained when they had succeeded down to the last period in describing chemical and physical qualities of the materials to be used and the exact details to be followed; just as in our country we have too great a tendency to regard our record file and office systems as ultimate ends. The specifications used in such important cities as London, Birmingham, Liverpool, Hamburg and Berlin, and even in Paris where the most attention is given to detail of any city in Europe, seem noticeably weak in contrast to ours and to leave much to the honesty of the contractor. Whereas when it comes to the execution of the work the attitudes are reversed, and the European engineer and contractor seem to work in harmony with but one end in view, namely, the construction of the particular piece of work called for at the price agreed upon. A recognition of the difference of national traits furnishes no indication of how to change them, except as pointing out the direction in which almost all of our cities can obtain better work, that is, in the line of closer inspection of materials and workmanship of construction. It is a problem that is worthy the attention of many men who may have a tendency to regard anything but the scientific end of engineering construction as beneath their dignity.

Even when his pavement is constructed in the best manner the engineer in charge of city highways has merely solved his preliminary problems and has remaining his real task of keeping the pavement down. Part of the solution of this question can be taken up after construction in the installation of an adequate system of keeping track of street defects and openings and the prevention of the latter by proper restriction on the issuance of permits and careful inspection of the work done under them; but the real method of controlling street openings so as to reduce them to a minimum is in the hands of the city planners and it is beyond the power of those charged with street maintenance to do more than regulate it to the best of their ability. It is in this line that the observer finds European superiority most apparent. He sees nothing in engineering construction problems as a whole done better abroad than here but does find European municipal governments taking charge of and regulating in an orderly manner first, the planning and laying out of street developments and then the installation in them, beneath the surface, of the necessary public utilities, so that when once constructed the street shall be as nearly permanent as possible. The chaotic condition of subsurface pipes beneath the streets in our great cities is notorious, but it is no argument except to those afraid to undertake any change to say that it must continue because it has always been that way. We must arrange in our new streets in entirety and in our older ones by changing whenever the opportunity occurs to provide beneath the sidewalks or footways for the installa-

tion of all necessary house service lines, leaving the space beneath the roadway for main sewers, passenger subways and the large water and gas mains, thus eliminating as much as possible our most frequent cause of street opening for the giving of additional house service to private parties.

In the office of the City Engineer of the city of Hamburg is a set of drawings showing standard sections officially adopted for all city streets of whatever width and on each is specified in its vertical and horizontal relation to curb and house line the position of each class of pipe and even the position of the trees and their longitudinal spacing are standardized. For the improvement of the worst of our old streets we can follow the example of London, which has constructed some six miles of pipe galleries in which are placed electric light and telephone wires and minor gas service lines. The installation of pipe galleries to any great extent is an almost prohibitive expense, but it is not impossible as a solution of the trouble in our densest streets, and by adopting the principle of utilizing the space beneath our footways, instead of presenting them for a nominal consideration to private parties, a great ultimate saving will be caused. Subsidewalk vaults need not be entirely eliminated for this, as a depth of only a few feet below the surface is required for the necessary pipes and wires; but our cities should not give up important space in their crowded streets merely to provide illumination by means of sidewalk dead-lights to the basement of adjacent buildings. It must be recognized, however, that the idea that only in this country do we make frequent street openings is a mistake.

No system can provide for all the necessities arising from future development, and only in a city which has ceased to grow would it be possible to conceal all evidences of construction. A careful observation shows in every great city of Europe conditions paralleling many of those complained of in our streets, particularly in regard to the extent to which the building constructor is allowed to use the public thoroughfare for his private purposes, even on such famous thoroughfares as Unter den Linden, the Champs Elysees and Regent Street; while it is of particular interest to call attention to the comparison in the number of street openings between the borough of Manhattan of New York City having a total mileage of streets of 455 and the city of Westminster, London, with 100 miles of street. The average annual number of permits granted for street openings in the former is about 25,000; in the latter, 20,000; and though it is undoubtedly true that the superficial extent of our excavations in New York is by far the greater, yet the figures indicate that even in the greatest city of the world there has been no final solution of the greatest problem which confronts the administrator in charge of the construction and maintenance of city streets.

In concluding these necessarily cursory notes, the fact must be emphasized that the choice of the most satisfactory type of wearing surface, is largely a local one. New York lays wood pavements only

on level streets, Berlin only on grades. Other forms of block pavement than those largely used in New York, are giving satisfaction elsewhere. Time does not permit of reference to the many successful brick streets and those of various types of bituminous concrete, within the limits of neighboring cities. The question of paving construction in and adjacent to the tracks of street railways, is a problem in itself.

One point above all must be kept in mind—careful work for a short time, will lay a good pavement; it can only be kept in its place in condition for use by constant vigilance. A thorough organization for the purpose of inspecting and reporting defects and for the execution of immediate repairs, is the prime requisite of a good highway bureau.

THE CHAIRMAN: The discussion of this paper will be opened by Captain J. W. Barnett, City Engineer of Athens, Georgia.

CAPTAIN BARNETT: *Mr. Chairman and Gentlemen of the American Highway Association:* I have been deeply interested in the paper which has just been read. I wish very much that I could have had access to this admirable document before the hour of discussion arrived, because there are many points of interest to engineers of this country contained therein and I would liked to have studied them more carefully before undertaking to lead in this discussion, but, in as much as I have not had the opportunity, I wish to make a few statements as to some of the most salient points. I feel that the author's wide experience and travel fit him admirably for the handling of this most difficult subject. I notice that he makes the statement that only 10 per cent of the total area of the pavements laid in European cities have a permanent foundation, a concrete foundation. That is a most startling statement to me. I have never gone into that phase of the question abroad very carefully, have been laboring under the impression that the European pavements were of the very best class possible, that they took every precaution to overcome any possible failure in the foundations. I can readily see from this statement how many grievous errors have been made in this country in the construction of pavements. I understand now how so many engineers have been led to believe that a permanent form of pavement can be constructed without the use of a concrete foundation, using this as a precedent. They evidently have not taken into consideration the different conditions existing abroad and in this country. The European cities are very old, their principal highways have been in existence for centuries and doubtless very little, if any, material changes have been made in the grades. Therefore they have a natural foundation which, is, comparatively speaking, very good, upon which to lay a pavement. In this country the reverse is true. The rapid growth of our cities has necessitated frequent and constant changes in the grades, leaving a foundation upon which we must lay concrete or some other form of material

sufficient to support the permanent surface. I note also, in this admirable paper that reference is made to the different proportions used throughout Europe and this country in the mix of concrete used in the foundations. A great many engineers have been misled by the proportions given in many specifications. They seem to think that a 1-3-6 or a 1-2-4 mix in New York City is suited for Atlanta regardless of the character of the ingredients entering into the mix. The profession is too prone to adopt the specifications of other cities. I think the proportioning of concrete is one of the most important things to decide. We should take the materials in hand, consider the percentage of voids and proportion the mix as may be required to form a dense concrete. I simply touch on this particular point because I feel that there are a great many errors being made in this, resulting in too weak a foundation to sustain the traffic. The increase in volume and weight of traffic is rapid. The advent of the heavy motor truck and other conveyances, carrying thousands of tons, necessitate a better class of construction than that used heretofore. The gentleman refers also to the matter of selection of the pavement. That is a matter that is not given proper thought. Political influences are too frequently brought to bear in making this decision. We do not consider as fully as we should traffic conditions and the interests of the adjacent property holders to the thoroughfares to be paved. We are inclined to adopt some form of pavement because some other city does.

The author refers to the matter of maintenance. To my mind that is the most serious problem confronting us today. The people of the South do not regard this question as they should. The average person feels that the pavement once laid is good for all time. If you see fit to make minor repairs in two or three years the taxpayer declares the venture a failure. Regardless of this feeling, repairs should be made promptly and systematically. It is an easy matter, with the experience of other cities, to select specifications that are effective; it is an easy matter to properly lay a pavement, but the question that gives most concern is that of maintenance. The Public Utility corporations are a great menace to our pavements—I mean the street railways, the telephone and electric light companies. Sewer, gas and water mains which have to be gone into frequently are the most disturbing elements. I do not know the practice in cities generally as to the matter of maintenance, but it seems to me that when an excavation is made in the streets that the repairs should be left entirely with the city officials, the engineering department. The engineer's office should be notified when the surface is to be replaced and a trained force sent for the purpose of restoring the pavements. That I think is the key note of success in the restoration of pavements where openings are necessary and have to be frequently made. From my own experience I know it is a matter of impossibility to get contractors and others who are paid so much per square yard to make a satisfactory job. Gentlemen, I thank you very much.

MR. KING: Suppose you have a macadam street or road or a gravel road, and you want to surface it with asphaltic concrete or something; would you tear that up in order to get the concrete base and build a concrete base? Did you ever try using the macadam and gravel road as a substitute for the concrete base?

CAPTAIN BARNETT: No, I have not. I am very glad you brought up that point. I will tell you what I am doing at Athens, Ga. We have quite a lot of macadam roads that have been down for from ten to fifteen years without any repairs of a consequence being made on them. Now they are full of holes and unsuited for the automobile traffic, so I have undertaken to substitute for the macadam a concrete pavement. I am ripping up the macadam and using the stone as a matrix, and I think we are getting excellent results.

MR. KING: We have a two mile stretch of road from the city limits to the country club in Memphis and it had been a splendid gravel road and we let a contractor surface that with two inches of asphaltic concrete, machine mixed method. The gravel of course was brought up to the proper contour, the holes filled and swept well. That has been down a year and a half; 300 to 500 automobiles traveling over it every day or so and it is holding out splendidly. I have a five years' maintenance guarantee. It cost \$10,500 a mile to fix that and put it down and we are using that gravel as a concrete base and I am watching it with a good deal of interest.

A MEMBER: What width?

MR. KING: It is 20 feet wide and wearing admirably; not a nickel of repairs so far.

CAPTAIN BARNETT: Under those conditions I am inclined to believe that a concrete road could have been built for the same amount of money and you would have a road that would be there long after your scheme will have been forgotten. We are building concrete roads for \$1.10 a square yard under the conditions named and along these streets we have street car lines, which increases the difficulty.

MR. KING: What will you surface with?

CAPTAIN BARNETT: Tarvia, a paint coat about a quarter of an inch in thickness.

DR. PRATT: At the outset, most of us in the South had an idea that this subject was applicable principally to larger cities, but there is one phase of the question of maintenance that is applicable to all our small towns and villages that I want to emphasize in a few words,

and that is I think we should draw a lesson from what has been done in larger cities, as for instance, borough of Manhattan, New York, where they had something like 400 and odd miles of streets and something like 25,000 excavations a year; we should take a lesson from them, that in our small towns and villages throughout the South when we permit those streets to be dug up, that we should be just as emphatic that the one responsible for digging up that street either puts up a bond or a sufficient amount of money as a guarantee that the road surveys of that town or village will be put back in as good shape as it was before he began to do the digging. We think that because perhaps our village streets are surfaced, or sand clay graveled, or paved with a block pavement or concrete, it is not necessary to make those stipulations with those who are digging up our streets, but many of you who ride in automobiles have felt the result of the indiscriminate digging up and making excavations in streets in our small towns, by coming across what is apparently a "thank-you-ma'm" across a street. There is no excuse whatever for those being allowed in any of our small villages or towns of the South or North or East or West, and we should be just as careful to have our streets put back in good shape as they are in the larger cities or towns. And then just one other thought in that same connection which also has bearing on maintenance, and that is where we have our water pipes and sewers put down through these streets, let us see if we cannot pass an ordinance that connections shall be made with abutting property before the surfacing is done on that road and not have the experience I had not so very long ago; within 30 days after a road had been surfaced, there were six applications to cut that surface to connect abutting properties with the water main, when the order had already been given three months before that they should connect with the water main. Of course that is the fault of those in charge of the town itself, but to my mind we should take these lessons from the larger cities and put them into practice in our smaller towns and villages.

MR. WILLIAMS (of West Virginia): Following up what Dr. Pratt says, Huntington, West Virginia, solved that problem in a measure; they have an ordinance requiring all places in the street where openings have been made in any street surface for the purpose of making pipe connections, to be concreted from the pipes up to where the base of the bricks, or whatever surface goes in, is put in. That makes it so that the man, the next time he goes to get in there, will have to tear up the entire concrete, and the effect of that causes most every fellow that has connections to be made, to get busy and get it made at the right time because the property owner or whoever makes the connection has to pay this extra amount and then afterwards he has to stand the expense of taking it out in case of any repair to be made; not only that, but the filling in of the concrete in that way prevents the thank-you-mam that the doctor refers to.

MR. WATKINS: In some of our cities in Washington, we have an ordinance that provides for putting water mains and sewer connections in at the time the water mains and the sewer pipes are laid to the property line for each sub-division of property, and there is a tax against that property and it has to be paid by the owner to provide for this and it obviates cutting up the streets.

MR. SHIRLEY: We charge \$1 a square yard for earth cut out, \$3 a square yard for macadam, \$6 a square yard for asphalt, brick or concrete; this is charged against whoever makes the opening. We have had quite a great deal of trouble over those charges. The department makes the repairs after the cut has been made. The trouble comes in with us that public service corporations charge the individual the cost of repairing the pavement, in some places it will run up as high as \$100. I have had delegations in my office of as high as 200 people asking to be relieved of that work. I have put down a pavement and after it has been down six months have had 39 applications made in a block to cut it for a new set of houses. That represented 39 families. I have had those 39 families to contend with and it is a problem. I would like to see some standard plan worked out. With us it is one of the most disagreeable parts of the work we have to handle. If you make these charges, public pressure is brought to bear to be relieved of them. We passed a rule that any pavement laid should not be opened for 4 years, and they even went to the legislature to make a new law about it. A man who owns a plot of land, we will notify him that a pavement is going to be laid at a certain time and that no opening will be made for 4 years. He will sell that land maybe two weeks after the road is laid; the land is developed, those lots are sold to different individuals, the individual makes the application for these water mains and if any of you here know what it means to have a home without water, gas, electric lights, etc., and have the ladies and gentlemen of the family behind you trying to get them in, you know you are up against a tough proposition.

MR. LEECH (of Steubenville, Ohio): We have an ordinance that authorizes the engineering department to make as many taps as they deem necessary before a pavement is laid down, and charge it to abutting properties. The Gas Company, likewise, make their taps for the property before a pavement is put down, under the directions of the engineering department; then we charge a permit of \$25 for tearing up a pavement within five years after it is put down. We have had very little occasion to tear up any streets in the last seven or eight years outside of what comes from a break or leak in the line. If a piece of ground is not sub-divided we imagine the sub-division and maybe we get in one or two too many but we put it in anyhow and charge it to the abutting property and it gives us very little trouble.

MR. DURHAM: There were one or two points brought out in the discussion which I thought it would be of interest to make a passing comment upon; one on the question of foundations. We do not in New York or anywhere else recognize the foundation as anything but some hard and durable non-compressive material on which the wearing surface is laid. Concrete is put there with the object of producing such a surface. If you have already a material just as hard and durable as concrete, there is no need of concrete. We have recognized that in one of our streets in New York where I was criticized by an inspector of the Finance Department who discovered that we were laying our concrete only 3 inches thick and I was called on for an explanation of that fact. It was supposed that a contractor was being allowed to scant his contract. In reply I pointed out that we were re-laying an old metallic road on a Telford base. There were 9 inches of good Telford in there and to pull out that good Telford to refill it with earth and 3 inches of concrete on top of that was ridiculous, so our concrete foundation is merely one means of getting a hard, incompressible foundation. The other points on the subject of street openings brought out quite an interesting discussion and I want to state that the problem in New York or London or in smaller cities is essentially the same. We require all applicants for permits to open a street pavement, to make a cash deposit of double the value of restoring that pavement. We inspect the work and then we, either with our city labor or a contractor, make the restoration and hold the balance of the money due for six months. In case there is no settlement the permittee gets the return of that balance. In case of any settlement, the pavement is resurfaced at his expense. In the case of a large public service corporation, it is permitted to put up a bond, but a cash deposit of \$5000 is also required, because it is so handy in case of emergency. The superintendent of an office building in which one of our great daily papers is published made an application to open one of our cross streets two weeks after the pavement was finished. I asked him why that was necessary and he said, "It is due to the action of the Water Department in making a change in the valve some distance away" whereby they had the possibility of only one connection to their building and in case of emergency the newspaper would be unable to go on and the wheels of the nation would stop. The permit was refused. The application was renewed with additional pressure. I saw that applicant and told him that if he would bring me a letter from the responsible editor of that newspaper, the application would be granted. It has never been renewed and the pavement has not been opened.

BITUMINOUS MACADAM BY THE COLD MIXING METHOD

BY IRVING W. PATTERSON

Chief Engineer of the Rhode Island State Board of Public Roads

The Rhode Island State board of public roads has, beginning with the year 1906, constructed a large amount of bituminous macadam by the cold mixing method, this type of construction being generally considered typical of Rhode Island State highway work. Reports of certain sections of our bituminous macadam construction have been rendered at gatherings of this kind in past years, but as a rule these reports were made so soon after the date of construction that definite conclusions regarding the success of the work could not be drawn. It is the writer's intention in this paper to give a résumé of this work since the date of its inauguration in 1906 and to draw certain conclusions regarding the points of construction and the adaptability of the cold mixing method, based upon his experience with work of this type in Rhode Island.

The first attempt made by the State highway authorities of Rhode Island to avoid the deficiencies characteristic of plain waterbound macadam construction by the incorporation of a bituminous binder was upon the so-called Post Road which practically parallels the south shore of the State. This road is subjected to the heavy through automobile traffic between the famous shore resorts of Rhode Island and the large cities to the south and west. A traffic census upon this road taken during 1913 showed an average summer travel of approximately 600 vehicles daily, consisting very largely of motor vehicles. The construction work upon this section was carried out during midsummer of 1906.

In 1906 there was little reliable information concerning bituminous macadam available, so the exact methods of carrying out the work necessarily had to be decided upon more or less arbitrarily. After considerable discussion by the engineers in charge of the work, it was decided to use a crude tar as a binder and to incorporate this material with the road metal by the cold mixing method. The mineral aggregate employed in the mix was crushed stone of sizes which were retained upon a one-half inch screen and which passed an inch and one-half screen.

The stone employed was native field and wall stone, which is a rather coarse grained, somewhat kaolinized granite.

The metalled surface was constructed 14 feet wide with a crown of three-quarters of 1 inch per foot.

All rolling was accomplished by means of a ten-ton, three-wheel steam roller.

The construction in brief was as follows. Crushed stone which was retained on an inch and one-half screen and which passed through a 3 inch screen was first spread over the well rolled sub-grade

to a depth of 4 inches after compression. This course was not filled with sand or stone screenings but was well rolled. Crude tar was very lightly sprinkled over this first course of stone. Crushed stone of the sizes stated previously was then mixed with crude tar in the proportion of 15 gallons of tar per cubic yard of stone. Mixing was carried out upon a portable wooden mixing platform placed as closely as convenient to the point where the mixture was being spread. The mixture of stone and tar was spread over the first course of crushed stone to a depth of 2 inches after compression. The mixture was well rolled, after which a covering of stone screenings was applied.

No foundations and no sub-drainage were deemed necessary upon this work because of the stable character of the gravelly sub-soil encountered.

The results secured upon this first experimental section of bituminous macadam were remarkably successful. No repairs have been required to date. The surface today is perfectly intact and presents a perfect mosaic appearance, due to the top surfaces of the stones in the mixture being all in evidence.

In 1907 a much longer section of bituminous macadam was constructed about one mile east of the first experimental section. The method of construction was almost identical with the construction employed the previous year. The results secured upon the section built in 1907 were inferior to the results secured in 1906. The surface began to ravel slightly in 1912, and during that year a seal-coat of refined tar was applied. Today the surface is somewhat irregular and a few breaks are in evidence, although the riding qualities of the road are very fair. We attribute the relatively inferior results secured from our work in 1907 largely to a less stable sub-soil.

It will be noticed from the foregoing brief description of the method of construction that no seal-coat was applied at the time of construction. Subsequent experiments have proved the advisability of seal-coating. We attribute the marked success of this early work in spite of the absence of a seal-coat largely to the character of the travel. The horse-drawn traffic over both of the above sections is very light, and we believe that the blows of horses' shoes upon the exposed surfaces of the soft stones would be destructive if horse-drawn traffic occurred in any considerable amount.

In 1908 bituminous macadam by the cold mixing method was taken up to much greater extent. Various experiments both in materials and methods were carried out, and today we are able to see that these experiments were largely negative in results produced. We tried many materials and combinations of materials which did not give satisfaction, and no work noticeably superior to the work of 1906 and 1907 was done. Results approximating those secured in 1906 and 1907 were secured, however, upon sections constructed in the same manner as were the bituminous roads built those years. Perhaps the greatest failures in the work during 1908 were upon sections where tar products and asphalt products heated in separate kettles were used in combination as a binder for the top course of

crushed stone. Where this combination of binders was employed, ravelling started the following year and increased in extent very rapidly as time went on. In 1913 a heavy seal-coat of asphalt was applied to several of the roads bound with a combination of tar and asphalt and the results secured from this treatment appear highly satisfactory.

In 1909 some very interesting experiments were carried out and these experiments produced some very positive results. It is true that there was work done in 1909 according to methods tried out in 1908 and since proved unsatisfactory, but at the date of the construction of the 1909 work it was not to be ascertained for a certainty what of the 1908 work was satisfactory and what was not, due to the short time the work had been done.

Upon the Nayatt Point road in the town of Barrington the most interesting and valuable experiments of the year were carried out. The section of this road selected for the experiments offered excellent opportunities for experimental work because of the remarkable uniformity and excellent stability of the sub-soil encountered. We are reasonably certain that foundation troubles have not been responsible for any of the defects which have developed in any of the experimental sections. These experiments have been completed long enough now so that we are enabled to draw certain definite conclusions from them. The results are not of any particular interest as far as the comparison of methods of construction is concerned but they are of great interest in the comparison of bituminous materials. We give below a report of these experiments, together with descriptions of the repairs necessitated upon each section and the appearance presented by each section October, 1914.

REPORT OF BARRINGTON 1909 EXPERIMENTAL WORK

All of the experiments were carried out between August 31, 1909, and October 22, 1909.

The soil encountered throughout is a sandy loam which allows of free percolation of water and is never subject to heaving due to frost action.

The traffic is composed largely of motor vehicles, although in early spring and late fall considerable heavy horse-drawn traffic is found. The traffic over the road is not excessive—a fair daily average of the number of vehicles passing over the road between May 1 and October 1, being very close to 350. During the remainder of the year, the traffic is less.

The metalled surface was constructed 14 feet wide and crowned three-quarters of an inch to the foot.

The stone employed upon all of the experimental sections with the exception of Section No. 1 was native field and wall stone which was in large part a fine grained, hard granite. Upon Section No. 1 Connecticut Trap Rock was employed.

The type of construction employed upon all of the sections was bituminous macadam by the cold mixing method.

The total depth of road metal was six inches after rolling. No foundations were deemed necessary because of the stable character of the sub-soil, and no sub-drains were constructed. The crushed stone was laid in two courses. The first course consisted of crushed stone which passed through a three-inch screen and was retained on an inch and one-half screen, laid to a depth of 4 inches after compression. Neither filler nor bituminous material was applied to this course. The second course of stone, into which bituminous material was incorporated, was laid to a depth of 2 inches after compression. The surface covering consisted of clean one-half inch stone screenings. The first course of stone was well rolled previous to the laying of the second course of stone.

Except upon two sections (Sections 7 and 8) mixing was done by hand upon a wooden mixing platform composed of two separate parts, each 8 feet square. This platform was laid on top of the first course of stone immediately ahead of the point where the mixture was being laid. Six men were employed in mixing the stone with the bituminous binder and shovelling the mixture onto the road. Mixing was carried out until all stones were completely covered with bituminous material. The crushed stone was not heated previous to mixing. In addition to the six men who did the mixing there were two other men in the gang who assisted in handling the bituminous part of the work—a raker who graded the mixture after it was shovelled onto the road and a man who took care of the kettles in which the bituminous material was heated. In the construction of Sections 7 and 8 a mixing machine known as the American Tar Company Mixer was employed. This machine was not a mechanical mixer, since it was in effect merely a special heated platform upon which mixing was accomplished by pulling by hand the crushed stone through a reservoir of heated bituminous material. The same number of men were employed in mixing with this contrivance as were employed in the mixing upon a mixing platform.

All of the experimental sections were seal-coated at the time of construction. The seal-coat was applied with ordinary house brooms.

All rolling in connection with the work was accomplished with a fifteen-ton, three-wheel roller.

The analyses of the bituminous materials were all made in the testing laboratory of the Rhode Island State Board of Public Roads.

EXPERIMENT NO. 1

(Crude tar and asphalt in mix with asphalt seal-coat—trap rock)

Construction. Upon our first experiment we employed a mixture composed of 50 per cent crude tar and 50 per cent hard asphalt in the mix. The tar and the asphalt were heated in separate kettles and applied separately to the stone upon the mixing platform—the tar always being spread over the stone first and the asphalt last.

A seal-coat of the same asphalt that was used in the mix was applied over the mixture.

The amount of binder employed for the mix was 18 gallons per cubic yard of stone.

The amount of binder employed for the seal-coat was $\frac{3}{4}$ gallon per square yard of surface.

The stone employed was Connecticut Trap Rock throughout. The first course of crushed stone consisted of the commercial $2\frac{1}{4}$ inch stone and the second course, with which the binder was incorporated, with commercial $1\frac{1}{4}$ inch stone which was claimed to be of sizes retained upon a $\frac{1}{2}$ inch screen and which passed a $1\frac{1}{2}$ inch screen.

Cost. The cost of this section was \$0.827 per square yard exclusive of grading.

ANALYSIS OF CRUDE TAR

Specific gravity.....	1.256
Water soluble material (organic).....	0.700 per cent
Water soluble material (inorganic).....	0.000 per cent
Free carbon.....	30.200 per cent
Ash.....	0.000 per cent
Fixed carbon.....	38.000 per cent
Melting point of normal material.....	too soft
Evaporation 5 hours at 170°C.....	18.600 per cent
Melting point of residue.....	70.000 degrees
Penetration of residue at 40°C.....	0.750
Penetration of residue at 25°C.....	19.600
Distillation.....	20.680 per cent
Up to 105°C.....	1.600 per cent
105°C. to 170°C.....	2.640 per cent
170°C. to 225°C.....	5.740 per cent
225°C. to 270°C.....	6.820 per cent
270°C. to 300°C.....	3.880 per cent

ANALYSIS OF ASPHALT

Specific gravity.....	0.994
Water soluble material (organic).....	0.190 per cent
Water soluble material (inorganic).....	0.000 per cent
Free carbon.....	0.270 per cent
Ash.....	0.290 per cent
Solubility in cold carbon tetra-chloride.....	98.730 per cent
Fixed carbon.....	12.600 per cent
Paraffine.....	0.410 per cent
Melting point of normal material.....	95.000 degrees
Evaporation 5 hours at 170°C.....	0.550 per cent
Melting point of residue.....	103.000 degrees
Penetration of residue at 4°C.....	20.000
Penetration of residue at 25°C.....	36.000
Evaporation 5 hours at 205°C.....	1.060 per cent
Melting point of residue.....	117.000 degrees
Penetration of residue at 4°C.....	14.000
Penetration of residue at 25°C.....	30.000
Solubility in 88° B. naphtha.....	68.300 per cent
Character of solution (oily or sticky).....	sticky
Viscosity 100°C.....	
New York Testing Laboratory viscosimeter.....	379.000 seconds
Viscosity 25°C.....	
Penetrometer.....	30.000

Results. This section was very nearly a failure. Hair lines developed inside of one month after completion and by the following spring ravelling had become quite extensive. Patching has been necessary each year since construction. What remained of the original surface by October, 1914, appeared rough and hair-lined and numerous breaks were in evidence.

We feel that the character of the stone employed in the mix was one reason for failure. The percentage of the smaller sizes of stone as compared with the percentage found in native stone was small in the commercial trap rock, so the rolled mixture consequently was far from compact. The combination of tar and asphalt in the mix is also to our minds a reason for failure. Such a combination has never given us first-class results, although with some grades of stone the results have been fair.

EXPERIMENT NO. 2

(Crude tar and asphalt in mix with asphalt seal-coat—native stone)

Construction. The second experiment was practically a duplication of Experiment No. 1 with the exception that native stone was employed in place of Connecticut Trap Rock. The binders employed were purported by the manufacturers to be identical with the binders used in Experiment No. 1, and the analyses of the materials showed that such was the case. The analyses were so nearly identical with the analyses given of the materials employed upon Experiment No. 1 that they are not here given.

There was a slight variation in the quantity of binder employed for the mix, 15 gallons per cubic yard of stone being used instead of 18 gallons. The same amount of binder ($\frac{3}{4}$ gallon per square yard) was used for the seal-coat.

Cost. The cost of this work was \$0.788 per square yard exclusive of grading.

Results. The results secured upon Experiment No. 2 have proven fairly satisfactory. There have been a few breaks in the surface which required repair. These breaks have occurred with increasing frequency since construction. The cost of maintenance during a period of five years was approximately \$0.025 per square yard.

Upon examination in October, 1914, the surface presented a smooth asphalt finish except in a very few spots where the seal-coat had worn off and allowed the surfaces of the stones to become visible. A sample of the road taken up showed, however, that there was no appreciable life left in the binder. The material in the seal-coat appeared to be in good condition.

The superior success of this section as compared with Experiment No. 1 we attribute to the superior grading of the sizes of the native stone with the resulting stronger mechanical bond.

EXPERIMENT NO. 3

Refined coal tar in both mix and seal-coat

Construction. Upon our third experiment a refined coal tar of the characteristics shown below was employed. The quantities employed were 16.5 gallons per cubic yard for the mix and $\frac{5}{8}$ gallon per square yard for the seal-coat. Native stone was employed.

Cost. The cost of this work was \$0.838 per square yard exclusive of grading.

ANALYSIS OF REFINED TAR

Specific gravity.....	1.222
Water soluble material (organic).....	0.400 per cent
Water soluble material (inorganic).....	0.410 per cent
Free carbon.....	24.700 per cent
Ash.....	0.100 per cent
Fixed carbon.....	29.390 per cent
Melting point of normal material.....	too soft
Evaporation 5 hours at 170°C.....	15.000 per cent
Melting point of residue.....	62.000 degrees
Penetration of residue at 4°C.....	2.000
Penetration of residue at 25°C.....	15.000
Distillation.....	19.690 per cent
Up to 105°C.....	0.000 per cent
105°C to 170°C.....	0.380 per cent
170°C. to 225°C.....	7.820 per cent
225°C. to 270°C.....	8.280 per cent
270°C. to 300°C.....	3.210 per cent

Results. The results to date have been very satisfactory, although a complete renewal of the seal-coat is called for. No repairs to the metallised surface were carried out until the fall of 1914, although the necessity for repair was evident for some time previous. The seal-coat began to disappear noticeably about one year after construction. Two years after construction a true mosaic surface was presented by the exposed surfaces of the crushed stone. The surface gradually became rougher, due apparently to the decomposition of the binder in the surface voids. Ravelling was not in evidence until the summer of 1914. The need for renewal of the seal-coat was felt in 1913, but since the section was experimental, we wished to see exactly how long it would be before disintegration set in.

Examination during October, 1914 (previous to any repairs being made), showed a rough mosaic surface with occasional evidence of ravelling. Abrasion of the stone by traffic was very evident, the surface being covered with a very light coating of particles of stone which apparently had been broken off from the stones composing the road surface.

EXPERIMENT NO. 4

Asphalt in both mix and seal-coat

The characteristics of the asphalt employed in this experiment may be obtained from the analysis given below. The quantities of binder employed were 21 gallons per cubic yard of stone for the mix and $\frac{5}{8}$ gallon per square yard for the seal-coat.

Cost. The cost of this section was \$0.898 per square yard exclusive of grading.

ANALYSIS OF ASPHALT

Specific gravity.....	0.965
Water soluble material (organic).....	0.320 per cent
Water soluble material (inorganic).....	0.000 per cent
Free carbon.....	0.340 per cent
Ash.....	0.030 per cent
Solubility in cold carbon tetra-chloride.....	99.620 per cent
Fixed carbon.....	7.990 per cent
Paraffine.....	0.160 per cent
Evaporation 5 hours at 170°C.....	16.600 per cent
Melting point of residue.....	65.000 degrees
Penetration of residue at 4°C.....	46.000
Penetration of residue at 25°C.....	105.000
Evaporation 5 hours at 205°C.....	19.100 per cent
Melting point of residue.....	116.000 degrees
Penetration of residue at 4°C.....	29.000
Penetration of residue at 25°C.....	58.000

Results. The results obtained upon this section are to date superior to the results secured upon any other section. No repairs have been necessitated.

Examination during October, 1914, showed a perfectly intact, smooth asphalt finish.

EXPERIMENT NO. 5

Refined tar containing 20 per cent of asphalt in both mix and seal-coat

Construction. The material used in this section was a refined tar mixed with 20 per cent of asphalt at the manufacturer's plant. The quantities of material employed were 24 gallons per cubic yard of stone for the mix and $\frac{5}{8}$ gallon for the seal-coat.

Cost. This section cost \$0.924 per square yard exclusive of grading.

ANALYSIS OF BITUMINOUS BINDER

Specific gravity.....	1.176
Water soluble material (organic).....	0.490 per cent
Water soluble material (inorganic).....	0.110 per cent
Free carbon.....	18.600 per cent
Ash.....	0.050 per cent
Solubility in cold carbon tetra-chloride.....	74.000 per cent
Fixed carbon.....	27.400 per cent
Evaporation 5 hours at 170°C.....	10.500 per cent
Melting point of residue.....	70.000 degrees
Penetration of residue at 4°C.....	2.000
Penetration of residue at 25°C.....	12.000
Evaporation 5 hours at 205°C.....	17.500 per cent
Melting point of residue.....	80.000 degrees
Penetration of residue at 4°C.....	$\frac{1}{2}$ degrees
Penetration of residue at 25°C.....	$2\frac{1}{2}$
Viscosity 25°C.....	
Penetrometer.....	too soft

Results. The results obtained upon this section are very fair. The surface became perfectly mosaic inside of two years from the date of construction, due to the disappearance of the seal-coat. No repairs have been given this section, but the need for a renewal of the seal-coat has been appreciated for two years.

Inspection during October showed a rough mosaic surface, perfectly intact as far as ravelling is concerned, and slightly darker in color than the surface of Section No. 3.

EXPERIMENT NO. 6

Refined tar containing 10 per cent of asphalt in both mix and seal-coat

Construction. The binder employed in this experiment was manufactured by the same concern which furnished the material for Experiment No. 5. The only difference claimed for the material was the different percentage of asphalt. The quantities of binder employed were 24 gallons per cubic yard of stone for the mix and $\frac{5}{8}$ gallon per square yard of surface for the seal-coat.

Cost. The cost of this section was \$0.917 per square yard exclusive of grading.

ANALYSIS OF BITUMINOUS BINDER

Specific gravity.....	1.211
Water soluble material (organic).....	0.580 per cent
Water soluble material (inorganic).....	0.000 per cent
Free carbon.....	22.500 per cent
Ash.....	0.090 per cent
Solubility in cold carbon tetra-chloride.....	69.500
Fixed carbon.....	26.200 per cent
Evaporation 5 hours at 170°C.....	13.500 per cent
Melting point of residue.....	67.000 degrees
Penetration at 4°C.....	1.000
Penetration of residue at 25°C.....	10.000
Evaporation 5 hours at 205°C.....	18.000 per cent
Melting point of residue.....	85.000
Penetration of residue at 4°C.....	$\frac{1}{2}$
Penetration of residue at 25°C.....	1 $\frac{1}{2}$
Distillation.....	18.690 per cent
Up to 105°C.....	0.290 per cent
105°C. to 170°C.....	1.000 per cent
170°C. to 225°C.....	3.290 per cent
225°C. to 270°C.....	9.430 per cent
270°C. to 300°C.....	4.680 per cent

Results. The results obtained upon Section No. 6, were not noticeably different from the results secured upon Section No. 5. No repairs have been carried out upon this section to date.

Observation during October, 1914, could disclose no differences in appearance or condition from Section No. 5, except perhaps a slightly lighter color.

EXPERIMENT NO. 7

Refined tar in both mix and seal-coat

Construction. Mixing in this experiment was carried out with an American Tar Company mixing machine. The amounts of material used were 24 gallons per cubic yard of stone for the mix and $\frac{5}{8}$ gallon per square yard for the seal-coat.

Cost. The cost of this section was \$0.910 per square yard exclusive of grading.

ANALYSIS OF REFINED TAR

Specific gravity.....	1.244
Water soluble material (organic).....	0.240 per cent
Water soluble material (inorganic).....	0.430 per cent
Free carbon.....	24.500 per cent
Ash.....	0.010 per cent
Fixed carbon.....	30.700 per cent
Melting point of normal material.....	too soft
Evaporation 5 hours at 170°C.....	11.900 per cent
Melting point of residue.....	63.000 degrees
Penetration of residue at 4°C.....	3.000
Penetration of residue at 25°C.....	15.000
Distillation.....	20.660 per cent
Up to 105°C.....	0.000 per cent
105°C. to 170°C.....	0.320 per cent
170°C. to 225°C.....	4.760 per cent
225°C. to 270°C.....	10.870 per cent
270°C. to 300°C.....	4.710 per cent

Results. The results secured in this work are not appreciably different from the results described in the report of Experiments No. 3, where also a refined tar was employed. Ravelling has not progressed to the extent that it has upon Section No. 3, but examination showed evidences of ravelling.

EXPERIMENT NO. 8

Refined water-gas tar

Construction. Mixing upon this section was accomplished by means of an American Tar Company mixing machine. The quantities of binder used were 24 gallons per cubic yard of stone for the mix and $\frac{5}{8}$ gallon per square yard of surface for the seal-coat.

Cost. The cost of this work was \$0.932 per square yard exclusive of grading.

ANALYSIS OF REFINED WATER-GAS TAR

Specific gravity.....	1.167
Water soluble material (organic).....	0.250 per cent
Water soluble material (inorganic).....	0.130 per cent
Free carbon.....	2.420 per cent
Ash.....	0.110 per cent
Fixed carbon.....	22.100 per cent
Evaporation 5 hours at 170°C.....	15.500 per cent
Melting point of residue.....	74.000 degrees
Penetration of residue at 4°C.....	0.500
Penetration of residue at 25°C.....	3.000
Distillation.....	16.830
Up to 105°C.....	0.000 per cent
105°C. to 170°C.....	0.000 per cent
170°C. to 225°C.....	0.000 per cent
225°C. to 270°C.....	10.390 per cent
270°C. to 300°C.....	6.440 per cent
Viscosity 25°C.....	
Penetrometer.....	too soft

Results. The results secured upon this section have been very satisfactory. One patch was necessitated about one year after com-

pletion, but no further repairs have been needed. The seal-coat has worn off, but decomposition of the binder has not extended down in the surface voids appreciably.

Examination during October, 1914, showed a smooth mosaic surface very dark in color as compared with the surfaces of the other sections which appear mosaic. The surface was perfectly intact. The need for a renewal of the seal-coat is beginning to be in evidence.

EXPERIMENT NO. 9

Crude tar in mix, asphalt seal-coat

Construction. Mixing upon this section was carried out by hand upon mixing platforms. The quantities of binder employed were 18 gallons per cubic yard of stone in the mix and $\frac{3}{4}$ gallon per square yard in the seal-coat.

Cost. The cost of this section was \$0.816 per square yard exclusive of grading.

ANALYSIS OF TAR

Specific gravity.....	1.256	
Water soluble material (organic).....	0.700	per cent
Water soluble material (inorganic).....	0.000	per cent
Free carbon.....	30.200	per cent
Ash.....	0.000	per cent
Fixed carbon.....	38.050	per cent
Melting point of normal material.....	too soft	
Evaporation 5 hours at 170°C.....	18.600	per cent
Melting point of residue.....	70.000	degrees
Penetration of residue at 4°C.....	0.750	
Penetration of residue at 25°C.....	19.600	
Distillation.....	20.680	per cent
Up to 105°C.....	1.600	per cent
105°C. to 170°C.....	2.640	per cent
170°C. to 225°C.....	5.740	per cent
225°C. to 270°C.....	6.820	per cent
270°C. to 300°C.....	3.880	per cent

ANALYSIS OF ASPHALT

Specific gravity.....	0.994	
Water soluble material (organic).....	0.190	per cent
Water soluble material (inorganic).....	0.000	per cent
Free carbon.....	0.270	per cent
Ash.....	0.290	per cent
Solubility in cold carbon tetra-chloride.....	98.730	per cent
Fixed carbon.....	12.600	per cent
Paraffine.....	0.410	per cent
Melting point of normal material.....	95.000	degrees
Evaporation 5 hours at 170°C.....	0.550	per cent
Melting point of residue.....	103.000	degrees
Penetration of residue at 4°C.....	20.000	
Penetration of residue at 25°C.....	36.000	
Evaporation 5 hours at 205°C.....	1.060	per cent
Melting point of residue.....	117.000	degrees
Penetration of residue at 4°C.....	14.000	
Penetration of residue at 25°C.....	30.000	
Solubility in 88° B. naphtha.....	68.300	per cent
Character of solution (oily or sticky).....	sticky	

Viscosity 100°C.

New York Testing Laboratory viscosimeter..... 379.00 seconds

Viscosity 25°C.

Penetrometer..... 30.000

Results. No ravelling has ever taken place upon this section. The only repairs necessitated to date have consisted merely in touching up spots where the seal-coat had disappeared. The expense of maintenance to date has been less than \$0.005 per square yard.

A smooth asphalt surface was presented by this section upon examination during October, 1914. There was no evidence of raveling to be seen, but in a very few small spots the disappearance of the seal-coat allowed the top surfaces of the stones to be seen.

CONCLUSIONS DRAWN FROM ABOVE EXPERIMENTS

These experiments at Barrington seem to prove that certain forms of the cold mixing method are very satisfactory upon roads subjected largely to motor vehicle traffic. Only two of the sections have necessitated repairs of any account during the five years they have been laid. Both of the sections requiring repair were laid with the same combination of binders, and the much greater extent of repairs necessitated upon the section constructed of trap rock is of interest in consideration of mineral aggregates.

It was shown conclusively that a seal-coat of asphalt is much more permanent than a seal-coat of refined tar, although both the crude tar and the refined tars gave excellent results as far as their binding of the mineral aggregate is concerned.

The effectiveness of refined water-gas tar is also proven. The section built of this product is superior at present to either section built of refined coal-tar.

BITUMINOUS MACADAM SUBSEQUENT TO 1909

In 1910 the typical construction employed was a mixture of crude tar and crushed stone, seal-coated with a heavy asphaltic product. It will be noticed that this construction is identical with the construction employed in Experiment No. 9 at Barrington the previous year. The facility with which the crude tar could be handled and the good results secured with this material previously accounted for its extended use in 1910. The results secured with this type of construction in 1910 were very successful. With one exception these roads have required only the lightest of repairs to date, the exception noted being located upon the main street of a large village and constructed of commercial $2\frac{1}{4}$ inch and $1\frac{1}{4}$ inch trap rock. This road had disintegrated somewhat by the spring of 1911, and from that time on the disintegration rapidly became greater in extent. By the spring of 1913 the condition of the surface was serious. Several breaks of 10 square yards or more in area appeared, and small breaks were very numerous. It was decided to patch the breaks

with a mixture of three-quarter inch trap rock and refined tar and to apply over the entire surface a seal-coat of asphalt covered with clean one-half inch trap rock screenings. Asphalt of approximately 15 mm. penetration was applied at the rate of one-half gal on per square yard of surface and covered while hot with screenings, which were rolled with a 6-ton tandem roller as soon as possible. This work was done in June, 1913. The results of this treatment have proved very satisfactory, no further ravelling having taken place to date.

Mixing in 1910 was accomplished by the hand mixing method upon wooden platforms.

The crude tar which was used to the greatest extent in our work during 1910 was the product of the Providence gas plant. Since 1910, vertical retorts have been installed at this plant and the crude tar at present produced is not suitable for use by the mixing method without previous refining. The Providence gas house tar used in 1910 was remarkable for its uniform good quality, and we doubt if we could duplicate the results secured that year with any crude tar at present available in sufficient quantity for our needs.

In 1911 no appropriation for road work was made by the General Assembly and consequently no bituminous macadam was constructed.

In 1912 an attempt was made to duplicate in effect the excellent results secured in 1906 by the use of crude tar by employing a comparatively light refined tar. It was the express intention to apply to the roads built with this refined tar a seal-coat of asphalt as soon as need for such treatment was evidenced, thereby securing eventually the same type of road which was so eminently satisfactory in 1910.

Mechanical mixing was introduced into our work for the first time in 1912. The type of mixer employed upon practically all of the work was a cube mixer of approximately one-half cubic yard capacity fitted with a heating device. The stone was not heated previous to mixing, the heating device being employed merely for the purpose of keeping the inside of the mixer warm so that it would not become clogged. The heat was developed by a flame generated by the combustion of crude oil sprayed under pressure, and this flame entered the mixer. It is the writer's opinion that this direct flame was responsible for burning the bituminous material in several cases.

The stone employed in the mix upon the work in 1912 was both local $1\frac{1}{2}$ inch stone and commercial $1\frac{1}{4}$ inch trap rock. The results secured with the local stone averaged superior to the results with trap rock.

The results secured upon our work in 1912 were variable. In 1913 it was deemed necessary to seal-coat with asphalt approximately 42 per cent of the total area of the roads constructed in 1912. During 1914 approximately 6 per cent of the total area was seal-coated with asphalt. The roads which have not been seal-coated

are in very good condition at present, but we anticipate the necessity for applying a seal-coat to all of them during the next two construction seasons. The seal-coating of the work done in 1912 has been very effective to date, but it is as yet too early to draw conclusions regarding the results of the 1912 work after seal-coating as compared with the results secured in 1910 where the seal-coat was applied at the time of construction.

During 1913 the amount of bituminous macadam constructed by the cold mixing method was small as compared with the amount constructed in 1912. Two methods were employed. The type of construction employed in 1910 was taken up to some extent with a refined tar in place of a crude tar—a seal-coat of asphalt being applied at the time of construction in exactly the same manner. An asphalt of characteristics similar to the asphalt employed upon Experiment No. 4 at Barrington in 1909 was used to some extent in both mix and seal-coat. The work by both methods has proved perfectly satisfactory to date, although the construction is so recent that definite conclusions cannot be drawn. Trap rock was employed satisfactorily in the mix for the first time during 1913. The commercial three-quarter inch size of trap rock was employed in place of the commercial $1\frac{1}{4}$ inch size which was previously used, and this product has given excellent satisfaction to date.

It has been proved in our work that the utmost care in constructing bituminous macadam by the cold mixing method is necessary. The crushed stone must be perfectly dry at the time of mixing and all stones must be perfectly covered with bitumen in order that good results may be secured. The manner of carrying out the rolling is also important in its effect upon the results obtained. It is, of course, necessary to secure by rolling as compact a mass as possible, but we have found that considerable care must be exercised in regulating the time and amount of rolling. If the weather is cool at the time of construction, we frequently postpone the heavy rolling until mid-day, when the maximum warmth is experienced, although the initial rolling is done as soon after the mixture is laid as possible.

The character and sizes of the crushed stone employed are also of great importance. We have secured the best results, as far as stone is concerned with our native rock, which is rather variable in character. As a rule our native rock is softer than trap rock and breaks with a much more irregular fracture than trap rock. There is more or less breaking of the native stone by rolling, and this appears to be beneficial rather than otherwise in that a denser pavement is secured. We feel that if trap rock is employed, smaller sizes are necessary than are necessary with a softer stone, unless there is a certainty of securing a perfect crusher-run from $1\frac{1}{2}$ inch to one-quarter inch or less.

We have experimented with heating the aggregate previous to mixing, but these experiments seem to show that inferior results are secured as compared with the results obtained with the same

materials where the aggregate is unheated. The aggregate in bituminous macadam contains at best a large percentage of voids, and in the heated aggregate there was noted a tendency upon the part of the binder to run off from the stones, leaving only a very thin coating upon each stone. In several cases, for instance, 18 gallons of binder per cubic yard of stone were necessary to cover all stones in our unheated mineral aggregate, but when the aggregate was heated, 12 gallons would cover all stones and there would be considerable bitumen which would run through the mineral aggregate and be lost. The tendency for the bitumen to cover a heated aggregate very lightly seems to be due to the fact that the heat retained by the stones does not allow the binder to become hard for a considerable time, with the result that it continues to run for some time. We recognize that it is necessary to heat the aggregate is a dense mixture such as a bituminous concrete pavement affords, but in bituminous macadam work by the mixing method we prefer a cold aggregate or an aggregate heated but slightly.

The weather conditions influence the results obtained in bituminous macadam by the mixing method considerably. We have noticed that roads built late in the fall just before freezing sets in are not apt to be as satisfactory as those built in mid-summer, even though the temperature at the time of construction is not low. It seems to be a decided advantage to roads built by this method of construction to have a comparatively long period of warm weather immediately after construction in order that the surface may become freed from the top covering of stone screenings and well smoothed out before snow and ice appear. In Rhode Island we consider the season most favorable to this type of construction to be between the middle of May and the middle of October.

Upon the whole, the cold mixing method of constructing bituminous macadam as practiced in Rhode Island appears to be an economical pavement for motor vehicle traffic. It does not appear to the writer as suitable for heavy horse-drawn traffic or for a heavy mixed traffic. The traffic upon several of the trunk lines in Rhode Island consists of motor vehicle traffic to the extent of over 90 per cent of the total amount of traffic, and it is upon these roads that we expect in the future to confine our bituminous macadam roads built by the cold mixing method. Through large villages where the percentage of horse-drawn traffic is large, we expect to take up a stronger method of construction.

THE CHAIRMAN: The next paper on the program has been taken from the afternoon session and transferred to the morning session. It is a paper on "Convict Labor," by Mr. George P. Coleman, State Highway Commissioner of Virginia.

CONVICT LABOR

BY GEORGE P. COLEMAN

State Highway Commissioner of Virginia

Prior to 1906 the convicts of this State were let out to contract, first, in the construction of railways and other public works, and then under one contract for the making of shoes. This was done in the Penitentiary enclosure, in buildings constructed by the contractor. In the revision of our constitution on 1903, section 185, provides that the Legislature may make provision for the use of her State convicts and jail men in the construction of State and county roads. With this end in view, the Legislature of 1906 passed the Withers-Lassiter law, placing certain of her convicts on the roads. This law has been amended by each succeeding Legislature until its provisions are about as follows:

A county or district of a county desiring to use convicts in the construction of its public highways, must make application, through the county road authorities, to the Highway Commissioner, for a force of convicts. This application must designate the road or roads to be improved, their approximate length and location and the amount of money on hand to carry on the construction. The Highway Commissioner will, as soon as possible after the receipt of this application, send an engineer to the county to make the necessary surveys for changes in location from which plans, profiles, estimates of cost and specifications are prepared. These estimates, plans, etc., are then furnished the county road authorities, and if agreed to by them, the Highway Commissioner then makes requisition on the Superintendent of the Penitentiary for a force of men. The county road authorities, in this second application, agree, on the part of the county, that the work shall be done under the direct supervision of the Highway Commissioner; they also agree that the work shall be done either by contract or by force account; if the former, the work is then advertised by the Highway Commissioner and the bids are opened at the county court house and the work is let to the lowest responsible bidder, subject to the approval of the commissioner. In this contract the contractor agrees to take a certain percentage of the whole amount in convict labor and agrees to use not less than a given number of men during the life of the contract. These convicts are furnished to the contractor at 10 cents per hour per man, the total for each month being deducted from the monthly payments of the contractor, the county thereby securing the benefit of this deduction. In the first contract made, it was agreed to furnish the contractor all labor necessary for his work, but it was found that under this plan the labor was used uneconomically and wastefully. The rules now require that a contractor shall not use less than 30 per cent, nor to exceed 40 per cent, of the total contract in convict labor. We are, however, working

away from this plan, that is, using convicts on contract work, finding that under the second plan, that of force account, we get better results both for the county and for the convict.

Should we decide to do the work by force account, the county road authorities agree first to have the work done under an engineer or superintendent appointed by the Highway Commissioner, who has complete charge of the whole work. They further agree to furnish all necessary teams, tools, machinery, materials, etc., necessary to economically and expeditiously carry on the work. They also agree to pay the superintendent and all necessary free labor, such as foremen, blacksmiths, etc., for it is not always possible to get this class of labor from the convict body. We also require the county to provide such medical attendance as the prisoners may require. The law requires that the prisoners shall be furnished by the Superintendent of the Penitentiary on the requisition of the Highway Commissioner. It further states that the Superintendent shall furnish a sergeant and the necessary guards to properly care for the men, stipulating, however, that the Highway Commissioners shall agree to the appointment of both sergeants and guards, and that if at any time the Highway Commissioner should see fit, the Superintendent must remove any sergeant or guard unsatisfactory to him. It further stipulates that the Highway Commissioner and the Superintendent shall agree on the necessary rules and regulations for working the convicts.

The Virginia convict road force is composed of all male convicts, who are considered safe by the Superintendent of the Penitentiary, and all male jail men over sixteen years of age, and this force, when placed on a county road or in a county quarry, is guarded, fed, clothed and transported at the expense of the State; this about equally divides the cost of the road work between the county and the State.

A suitable camp site is selected with a view to proper drainage and a plentiful supply of good water; also that the men will not have to walk at any time exceeding two miles to or from their work. This is particularly important, since walking in gangs of ten to twenty is necessarily slow. The camps for the men are divided into a sleeping house, wide enough for a row of cots down each side, and an 8 foot passage way down the center, built to hold from fifty to eighty men. The men are supplied with all necessary bedding, etc., and in winter the building is heated with stoves. Next to this is the dining camp and at one end of this is the store room, kitchen and guards' dining room. Facing these, and a little to the side, is a camp with two rooms, one for the sergeant and the other for the guards. All of these buildings have corrugated metal roofs, and canvas sides, and the sleeping quarters have wooden floors and are so constructed that they can be readily taken down and moved to new locations. In addition to the sergeant, there are from three to five guards, depending on the size of the camp. The pay of the

sergeant at first is \$50 per month and his board, which amount is gradually increased to \$75 per month and board. This amount may be further increased by placing the sergeant in charge of the road construction. The pay of the guards begins at \$25 per month and board, and may be increased to \$35 and board. The guards are also required to supervise and direct the work of the men when called on to do so by the Superintendent, but with the class of men available at the price, this has not been found practical. The salaries of the sergeants and guards constitute the heaviest cost of maintaining the State convict road force, and up to the present time we have not been able to devise any plan which will enable us to materially reduce this cost.

As a general thing, from three to five prisoners are kept in the camp to do the cooking, cleaning, washing, etc. The remaining men are divided into gangs of from four to twenty men, the worst class of the prisoners being placed under guard and worked in the quarries or gravel pits or on the grade. The trusties are sent off in small gangs to shape the road, spread stone, build culverts and headwalls and are used as blacksmiths, firemen, rollermen, drivers and water boys. The best men in the quarries and on the grade are trained as drill runners and enginemen and if their behavior warrants it, are made into trusties and sent off on work not requiring a guard.

The Legislature of 1906 appropriated \$25,000 for the maintenance of the convict road force for eighteen months, and the last Legislature appropriated \$145,000, together with the jail fees, which will give us about \$180,000 for the maintenance of the force for 1914. Since the organization of the Department, we have used convicts in thirty-seven counties and at the present time we are maintaining camps in thirty-one counties, representing about eleven hundred convicts and five hundred jail men working on the roads of the State. It has cost the State during the past year to clothe, feed, guard and otherwise provide for this labor, approximately fifty-one cents per ten hour working day. It is quite impossible to compare convict labor with free labor unless you are working them side by side and under exactly the same conditions. I have heard a great deal said about the inefficiency of prison labor as compared with the same class of free labor, the usual argument being that you cannot expect to get the same results from men working under compulsion and without compensation and hope of advancement. From eight years' experience, we are of the opinion that prison labor properly handled, that is, with intelligence and humanity, is just as satisfactory and efficient as any other class of common labor. with the additional advantage of being regular and under perfect control. You are in a position to train each man for his particular work and to derive an immediate benefit from that training.

Now of course we get all classes of men sent to the roads, some whose physical condition is such that they are incapable of doing

hard work; these are made into water boys, yard men, drivers, etc.—in other words, they are given such work as they are capable of doing. We have found that working prison labor on the roads is not without its drawbacks. In many sections of the State the work is light and it is not always advisable to string your men out as needed. Nor is it possible or economical with the funds in hand to employ a sufficient number of guards. Our experience has led us to believe that the most economical results can be obtained from prison labor working under guard, when that labor is concentrated and when it is worked near their headquarters. One thing is certain—the use of prison labor on the roads in Virginia has quickened the demand for better roads and given an impetus to the movement that nothing else has ever done. So much, then, for the benefit accruing to the counties and the State from the use of this labor in improving her highways.

The State realizes that its first duty is to improve both morally and physically this class of its citizens, and to send these back into the world better able to cope with its temptations, and we feel that road work is a move in the right direction. In dealing with this phase of the question, you must not lose sight of the fact that about 75 per cent of the prison population of this State is negro, and that your problem is thus made doubly difficult. The prisoners in our road force are allowed a reduction in their term of imprisonment of four days each month for good behavior, and when they prove that they can be trusted and are competent, they are given more skilled employment. It is the endeavor of each sergeant to have as many trusties on his work as possible; these men are put on special work without guards, and are allowed special privileges. Should they, however, break the rules or regulations, they are, as a punishment, placed back under the guard. The men are well clothed and fed and generally well cared for—they live and work out of doors and while each man is required to do a full day's work, they are never driven. There are a number of instances where the men on the completion of their sentence have been employed by contractors on the same work at good wages, and in many instances employed by farmers who live near the road work, and in this way they are kept away from their former haunts. One of the direct advantages to the convicts working in these camps, must be the training they receive in cleanliness and sanitary precautions of every kind. Consider that most of them are from the slums of cities, that few of them have ever received training of any sort in the proper care of themselves physically, and you cannot fail to realize how much they must gain from the practical lessons they receive in assisting in the locating and management of the camps. The careful choice of a site, the precautions taken in guarding the spring or well from which the water supply is obtained, the disposal of all sewage, the cleanliness of the kitchen and the utensils used and the isolation of any member of the camp suspected of any infectious disease—

these are all points on which the State officers have expended much time and many thousands of dollars to bring forcibly home to their uneducated citizens, and in no way could a class most needing such education receive it more thoroughly or clearly than in a well ordered road camp. Another important advantage derived from working prison labor on public highways, is that it brings the average citizen in touch with the situation, thus giving him an entirely different point of view; he is able to see for himself that very few of the convicts are dangerous and that many of them, if given a chance, will make good citizens. Changes are undoubtedly needed in the management of our prison labor, but it is difficult to lay down any one rule and say that if you follow this you will get the best results for the men, and therefore for the State as a whole.

The Superintendent of the Penitentiary proposes to make an effort to get the Legislature of Virginia to provide an appropriation with which to pay each prisoner who obeys the rules five cents for each day's work. This will amount to something like \$15 per annum for each prisoner and it is proposed to pay that amount to the prisoner on the completion of his sentence. This will permit the discharged prisoner to have a small amount of money to start with on his release, and it is to be hoped that some such law will be enacted at the next session of the Legislature, for according to our present law, the prisoners are discharged without help of any kind other than their transportation, except such as is voluntarily given by the sergeant or men in charge of the road work.

I would like, however, to suggest for your consideration, the following plan which could be followed to advantage in this State, that is, grouping your prison population into four classes:

First. Long term and dangerous men.

Second. Short term men.

Third. Trusties.

Fourth. Paroled men.

The first class shall include all murderers and all prisoners whose records are known to be bad and all prisoners sentenced for third offences.

These men are to be dressed in stripes and worked in stockades and under guard in State stone quarries. This material is to be supplied to the counties of the State to be used in the construction of their roads. It would, of course, be necessary to locate these quarries advantageously and with good transportation facilities. It would also be necessary to secure low transportation rates from the railroad companies to insure an economical distribution of the material.

The second class, to be composed of short term men, men convicted for the first time, and such men from class I as by experience you would find that you could trust even a little, these men to be dressed in blue or brown and distributed throughout the State to the various county road camps and to be worked under guard in the grading and construction of the county roads.

The third class, to be composed of trusties, or, if you please, Honor men, and to be taken from class II, these men to wear an ordinary khaki suit and to be worked without guards and used as rollermen, enginemen, cooks, yardmen in the State and county camps, in small gangs to shape road and spread stone, in building concrete bridges, culverts and headwalls, and in every way made to feel that they are in places of trust and above all that they are being trusted. We have considered the matter of working prisoners in large forces, without guards, as is being done in some of the Western States, but have not yet been able to devise a plan which appeared feasible with the class of prisoners we have in our camps, though we may be able to do so later.

The fourth class, paroled men. These men to be taken from class III and paroled for good behavior at some period of their sentence, I would suggest at the expiration of half of their time. These men to wear ordinary clothing and to be assigned to the maintenance department of the State or county, to be used as patrolmen on maintenance of the roads or on such other maintenance work as may seem best. These men to be furnished with proper quarters and paid a monthly wage, and where practical, given a house and small plot of ground and urged to have their families with them, these men to be a regular part of the State or county's free labor road system, the only difference being that they shall be required to report monthly to some general head.

THE CHAIRMAN: The discussion on this paper was to have been opened by Mr. J. E. Maloney, State Highway Engineer of Colorado. Mr. Maloney is unable to be present but has sent his paper in, which will be read.

CONVICT LABOR IN COLORADO

JAMES E. MALONEY

Secretary-Engineer State Highway Commission

In discussing the very interesting paper of Mr. Coleman, to my mind, the question resolves into a general proposition for improving the condition of the prisoners, and at the same time performing some useful work for the State.

In considering the question of convict labor, it is well to keep in mind these two propositions; one, the regeneration of the convict himself and his future welfare, and the other, the financial benefit to the State. If it is possible to accomplish both of these points, then indeed, is the practice of working convicts on the roads, a benefit to both the State and the prisoners.

The selection of the trusties and the placing of the men at the various tasks are functions which belong to the warden of the Penitentiary, who is in direct touch with the men, and through his

study of human nature is enabled to pick out the men best suited for the different positions.

In Colorado, in addition to the various tasks for the upkeep of the Institution, such as the laundry, hostlers, gardeners, etc., the State has a farm of several hundred acres, on which, during the summer season, many of the prisoners are employed.

In addition to this, starting from the year 1899, the employment of the prisoners upon the State highways has been gradually extended, until at this time our present warden, T. J. Tynan, has seven road camps at work in various parts of the State, employing an average of 250 prisoners in total at these seven camps.

The first work in 1899 was done in the upper Arkansas River Valley, in the neighborhood of Buena Vista, under the bill introduced in the Legislature by Senator T. J. Ehrhart. In this year considerable work was also done in Fremont County by the convicts. Later, in 1905, a bill was introduced by Senator Lewis, and another one in 1907 by Senator Barella, the latter bill providing for a convict built road from the New Mexico State line at the south, to the Wyoming State line on the north. The Lewis bill, is the one under which our convicts are now being successfully worked on the roads under the present administration. Copy of this bill follows:

S. B. No. 224, by Senator Lewis.

AN ACT

Providing for the working of the convicts in Colorado State Penitentiary upon the public roads and highways within any county and upon the streets and alleys within the cities and incorporated towns located in the State of Colorado.

Be it Enacted by the General Assembly of the State of Colorado. SECTION 1. Upon the written request of a majority of the board of county commissioners of any county in the State of Colorado, the Warden of the Colorado State Penitentiary, situated at Canon City, in Fremont County, shall detail such convicts as in his judgment shall deem proper, not exceeding the number specified in said written request, to work upon such public roads and highways of such county or streets and alleys of any city or incorporated town within such county as shall be designated in said written request of said county commissioners; Provided, That such county shall pay all additional expense of guarding said convicts while working upon said public roads and highways within such county, and shall furnish all tools and materials necessary in the performance of said work; And, Provided, That when said work is done within the limits of any city or incorporated town within such county, or city or incorporated town where said work shall be done shall likewise pay all additional expenses of guarding such convicts while performing said work and shall furnish all necessary material used in said work.

SECTION 2. Said convicts when employed under the provisions of Section 1 of this act shall not be used for the purpose of building any bridge or structure of like character which requires the employment of skilled labor.

SECTION 3. The Board of Penitentiary Commissioners are hereby empowered to adopt a special rule applicable solely to convicts employed on the public work herein authorized and contemplated, whereby convicts so employed shall be granted additional good time allowance, conditioned upon their good behavior and cheerful compliance with all rules that may be made by said board or said superintendent for the management and control of convicts so employed.

SECTION 4. All acts, or parts of acts, in conflict herewith are hereby repealed.

SECTION 5. In the opinion of the General Assembly, an emergency exists; therefore, this act shall take effect and be in force from and after its passage.

Approved April 11, 1905.

Work was started on the main State road from Trinidad to the New Mexico line, and finished in 1907 by Warden Cleghorn. The famous "Sky Line Drive" at Canon City was also completed under Mr. Cleghorn's administration, and the development of the system of working convicts without gun guards and solely upon honor was started by Mr. Cleghorn. Our present warden, T. J. Tynan, took charge of the work in 1909, and has extended and developed the system, until at this time it is one of the very successful adjuncts of the State system of road work.

It has been stated by one of the superintendents of the convict camps, that "The use of this labor not only cheapens the construction to the State, but takes the men out into God's sunshine, where the steady employment and wholesome life of the road camps are accomplishing wonders in arousing energy and ambition, and some of these men have never before realized that they were capable of doing an honest day's work. Prison labor has some disadvantages. The men from all walks of life are thrown together, and in most cases they have to be taught the use of the road builder's tools, but as the work progresses, the majority of them learn to take an interest and pride in their work."

The convict camps are made up of all nationalities and races, many Mexicans and negroes being among them. The desire to take advantage of the opportunities offered by the work upon the roads, is shown by all the prisoners, and the great majority of them soon exhibit a very keen interest in the work. All classes of crimes have been represented by the convicts worked upon the roads. It has not been found desirable or necessary to divide the convicts into classes, segregated according to the character of the crime, and if there is any division to be made between the prisoners, it should be based upon the individual characteristics of the prisoners, rather than upon the crime for which he has been convicted.

The State does not pay the convicts any salary or per diem for their labor, but they receive credits, which enable the prisoner to cut his minimum sentence in half. Any attempt to escape or violate the established rules results in the loss of all credits, and instead of cutting his time practically in half, he has to serve his full maximum sentence. There are no armed guards used in any of these camps, the men being placed entirely upon their honor, and I believe this is one reason for the very satisfactory results obtained by the present warden. If you use armed guards to restrain the prisoners from any attempt to escape, then why exact any promises from the men, but if you accept a promise from them, to the effect that they will not attempt to escape, then they should be trusted. Other-

wise, the moral effect of their promise is absolutely lost. Under our present system, the attempts to escape have not been over 1 per cent, and when 99 per cent of the men keep their word, it stamps the system as successful.

The typical organization of the convict road camp is about as follows:

The camp is under the charge of a superintendent, who is assisted by one, two or three foremen, as the size of the camp may require. These men are all the salaried officials there are connected with the camp. An average of 25 to 50 prisoners may be detailed to any one camp. In all of the camps of the State the quarters are provided by the county and State Road Fund, as distinguished from the Penitentiary Fund. This equipment consists of wall tents of extra heavy canvas, with flies, and in case of winter quarters the walls of the tents being boarded and papered, and stoves provided. The men sleep in separate bunks in tents provided for that purpose, about 4 to 8 to a tent. There is a superintendent's tent, necessary shelter for the stock, etc., and in fact, the equipment is the same as would be used by a contractor prosecuting the same piece of work, except that the men are better provided with shelter, clothes, and food.

The sanitary conditions are looked after very carefully; the cleanliness of the camp, and the physical well-being of the men are especially looked after by those in charge of the work. Sanitary precautions and close inspection of the health of the men are points which are conducive to better work.

The stock necessary for the hauling of supplies to the camp, or for working upon the roads is also supplied by the County and State Road Fund. An outfit for camp purposes may run from \$1000 to \$2000, not including the cost of the stock. Clothes for the prisoners are supplied by the Penitentiary. A prisoner's transportation is furnished by the counties, except where a prisoner is returned to the Penitentiary for any infraction of the rules, or attempt to escape, in which case the Penitentiary stands the expense. No armed guards of any kind are used at any of Colorado's convict camps. As a general rule, the night watchman is one of the prisoners.

The pay of the superintendent runs from \$100 to \$125 per month. For assistant foremen, the salary runs from \$75 to \$90 per month.

In the last two years the prisoners have constructed a total of about one hundred miles of road.

Under the law, the control of the convicts is entirely in the hands of the warden and penitentiary officials, the supervisors and foremen being appointed by them, and this is, I believe, the proper method, as the prisoner is in the custody of the warden, and the warden is responsible for him during the term for which he is sentenced.

The State Highway Commission has assisted the counties and prison officials in the establishment and employment of the road

camps by apportioning funds to the counties for the construction of certain pieces of the connecting State Highways, and enabling the counties to equip and maintain the camps. The position of the Highway Commission in connection with the convict road construction is purely advisory; the matter of the engineering assistance and suggestions being made through the county commissioners, who are the active executives in dealing with the warden of the Penitentiary.

In regard to the actual costs of maintenance for these camps, I submit the following statements, which include four camps, as follows:

No. 1. Two camps for the season of 1913 and 1914; No. 3. One camp from June, 1913 to October, 1914; No. 4. One camp during 1913 and 1914—total 24 months.

In the first two camps during 1913 from October 1912 to July 1, 1913, or ten months, the total cost was \$6284.74 (equipment not included). The total number of days in that period of time was 308. The total number of days worked was 248. The average cost of food per man per day was $31\frac{1}{2}$ cents; the average cost per man per day was $61\frac{1}{2}$ cents; this includes all salaries, repairs, stock feed, etc; and the average cost per man per day actually worked on the roads was 77 cents. The average number of men in camp for this time was 40, about eight of these being used about the camp. The average number of head of stock, 8; average cost per mile of road built, \$2513.89; they having completed $2\frac{1}{2}$ miles of mountain side hill work, 16 feet in width.

In this second camp for the season of 1914, or from August 1, 1913, to September 1, 1914, being 13 months, inclusive, the total number of days was 396. The total number of days worked was $296\frac{1}{2}$. The average number of men, 33; the average number of head of stock, 6; the average cost per man per day for food was 37.6 cents, and the average total cost per man per day was 89.15 cents; the average cost per mile, \$3163.60, a total length of 3.67 miles having been finished during the season at a total cost of \$11,613.96. The average cost per man per day actually at work on road, \$1.50. This includes a drilling outfit, which cost \$2000.

The work consisted of mountain sidehill and some very heavy rock for about $1\frac{1}{4}$ miles; the balance was earth and loose rock, moderately heavy timber clearing; the roadway averaged 16 feet in width.

In the third camp, the work started June 10, 1913 and extended to October 1, 1914 inclusive, making a total of 15 months. During this time some $6\frac{1}{2}$ miles has been completed, at a total cost of \$29,164.38. This includes about \$1800 for a portable drilling plant, and gives an average cost of \$4487 per mile. Of this work about 4 miles is in heavy rock work, and about $1\frac{1}{2}$ miles in heavy earth and gravel, and 1 mile of light earth work.

In the next camp the convicts have been at work for the past four seasons, and their work is mostly in open prairie country, and

has consisted of a great deal of work with blade graders and traction engine haul for the graders, and also horse haulage for the dirt, and the grading and scraping machines. The average number of men employed has been 25; the average number of horses employed has been 16; the total miles of road improved has been 94; the total number of bridges and culverts built by the convicts was 60; and the total miles surfaced, 61. The average cost of this work to the county for the past four seasons has been approximately \$1150 per mile, including bridges and culverts.

In estimating the comparative value of the convict labor as against the free labor, it would be essential to have the yardage moved and to have the classification of material. As in the case where the counties do their work by day labor, the engineer does not always cross-section the work, simply placing the center and grade stakes for the use of the superintendent, and an occasional cross-section stake, giving the width and general outline.

This, however, is not sufficient to fully calculate the yardage on any of these pieces of work. A comparative idea may be had by the actual cost of labor per day per man actually at work on the road. This runs from 77 cents to \$1.50 per day; and having this figure prepare the relative efficiency of the labor as between the prisoner and the ordinary road laborer. I believe this work of the prisoners will show an average saving of about 25 per cent for the conditions under which they have been worked in this State. In some cases a much larger saving than this is shown, and in other cases the saving is smaller. In starting an outfit for this kind of labor many drawbacks will be encountered at the beginning, especially in the selection of men to superintend the camp, and this is an important position, but once started they can be kept running smoothly.

In conclusion, I can say that our experience with this method of employment for the prisoners committed to the Penitentiary or Reformatory, has been entirely satisfactory.

THE CHAIRMAN: Mr. E. R. Morgan, State Road Engineer of Utah, will continue the discussion on this paper.

MR. MORGAN: You, no doubt, have observed that in Mr. Coleman's opinion the use of convict labor has two main purposes, namely, the utilization of their energy from an economic point of view, and the uplift of the prisoner from a humanitarian point of view. The fundamental conception of the problem will likely be accepted by all. Using it as a basis, the conclusion is justified that the system, which has been in use in Virginia and is yet, at least to some extent, is not an efficient one, as it must be apparent that a contractor is chiefly concerned with the economic phase of the question. It is probably true that whatever consideration the question of benefit to the prisoner receives from the contractor is incidental,

and contingent upon the pecuniary benefit he is to get from the use of the convict's energy.

Convict labor must be entirely in the control of the State or the county concerned, and used exclusively for the benefit of such community, and the convicts. The intention of the officials of the State of Virginia to obtain a monetary consideration for the convicts is commendable for, no doubt, even a small sum of money at the expiration of their terms would tend to prevent their committing further crimes during the period in which they should be endeavoring to place themselves on a self-sustaining basis. The amount of money set aside from the funds of a community, county or other political sub-division on account of services performed by convicts, should be materially increased; part of it to be retained by the State for expenses of prosecution, keep, etc.; part to be paid to the dependents rendered so by the crimes committed by the respective prisoners; and the remainder to be paid to the prisoners at the expiration of their sentences.

As mentioned by Mr. Coleman, there is no doubt that convict labor can be more advantageously prosecuted if the convicts are properly classified. The classification, however, in my opinion, should be made with reference to the character of the men; if working in separate camps and with reference to the kind of service they are capable of giving, if laboring in the same camp.

Utah is yet struggling with the A B C's of convict labor. Nevertheless, I believe that to note what we have done in this matter will be helpful in the discussion of the question.

The Legislature of Utah in 1909 enacted a law, which provided that prisoners in the State prison may be required to work on the roads under regulations made by the State Board of Corrections. Boards of County Commissioners wishing the services of the convicts were required to make application for them to operate them under the State Board of Corrections without financial assistance from the State for their subsistence while at work. Convict labor on the roads in Utah was hitherto untried, and the results were unknown. The inducements by the law for the use of convicts on the roads were thought to be small, and therefore, the law failed. In 1911, the Legislature enacted a law giving the State Road Commission, and the State Board of Corrections control of convict labor on State roads. The supervision of the work was given to the State Road Commission. Power was granted to the State Board of Pardons to give privileges to convicts who perform service upon roads, public buildings or grounds, especially a reduction of sentence, conditioned upon their good behavior and efficient service while so employed. Twenty thousand dollars was appropriated for the use of the warden in the purchase of camp equipment and supplies, paying for the service of extra guards, and the transportation of men and camp equipment. There was also appropriated for the use of the State Road Commission the sum of \$40,000 for the purchase of construction equipment.

In May and June of 1911, the State Road Commission purchased equipment amounting to about \$15,000, and work was commenced in July. The work undertaken was a macadam road in Box Elder County. Between 40 and 50 convicts were employed on the road. They were directed by a construction superintendent who was assisted by 4 guards. The road was first graded, cobble stones were gathered from the adjacent hillsides, crushed and delivered on to the road by teams, spread, rolled and sprinkled, after which the drains were made. From this statement, it will be seen that a variety of service was rendered, some of which was skilled. There were built 2.5 miles of road at a cost of about \$2000 per mile. For camp purposes in this work, the use of a 5-acre tract of land was obtained. The kitchen, dining and sleeping tents were enclosed in a stockade made by building a barbed wire fence, 10 feet high, around a 125-foot square. The wire was spaced 4 inches. The prisoners were guarded day and night. Each line of fence forming the enclosure was illuminated at night by carbide lights. During the operations of this camp, two men escaped from the enclosure but were recaptured.

In December, 1911, about 20 trustees were taken to Washington County and worked until about the middle of the following April, during which time, they were not guarded closely and no man tried to escape. This is mentioned in order that the progress in convict management may be noted.

In August, 1913, the State Road Commission more than doubled its construction equipment. The convict camp was enlarged to about 70 men, and the construction of the concrete road undertaken.

The population at the Utah State Prison varies between 275 and 300 men. About 40 of these are working outside the prison walls, on the grounds and farm. In order to obtain 70 other men who could be trusted and who were capable of performing the desired service, considerable care and judgment was required. A number of long term men including murderers, burglars, and holdups were selected. At the camp, the dining, sleeping and kitchen tents were located within a square surrounded by a single smooth wire which was illuminated at night by carbide lights at diagonal corners. For the safety of the prisoners, a head guard was made responsible. He was assisted at night by 4 guards. The prisoners were guarded and directed in their work during the day by 4 other guards, who in turn were directed by the head guard and the construction superintendent. The double headed organization is notable and objectionable from the standpoint of expense, but it is nevertheless difficult to obtain guards with construction ability or construction superintendents who will assume the responsibility of convict camp discipline.

Material and supplies were hauled from Salt Lake City to the road by convicts a distance of 6 or 7 miles without an accompanying guard, so it will be seen that considerable freedom was allowed the prisoners.

About 4 miles of concrete road 16 feet wide and 7 inches thick were constructed. The road which has been built has cost about \$8000 per mile. Prison labor has lessened the cost per mile from \$1500 to \$2000.

The State Board of Pardons authorized the warden to allow a commutation of sentence of 10 days for every 30 days the prisoner spends at the road camp regardless of whether he is sick or whether the weather conditions will permit of the work being prosecuted, conditioned, however, upon the faithful observance of camp rules. During the time they have been employed, 8 have escaped from camp, 5 of which have been recaptured, a very enviable record from a purely prison management point of view.

At camp, after working hours, on Sunday and holidays, they are permitted to play ball, pitch horseshoes, or engage in other recreative exercises. About 20 good magazines are furnished regularly for the use of the camp. Daily papers are allowed, but not furnished.

The camp at present is provided with bathing facilities so that every man may bathe daily if he wishes and must do so at regular intervals.

The attitude of the guards toward the men is kind, and considerate. No guard is allowed to use profanity when addressing a convict. The guards and the construction superintendent instruct the men as to how to perform the required service in a considerate manner, which instruction is received generally in the same spirit that it is given.

They are fed plainly but substantially. The general attitude of the men toward the work in hand and the conditions generally surrounding them is good. They frequently manifest interest in the work and rarely does discontent spread beyond a few.

As an example of discontent and discipline, the following was recently observed. A number of teams were grading. One of the drivers, a convict, stopped his team and refused to proceed. The guard in charge directed the other men to drive their teams around his. This was done for a considerable period of time, after which the disgruntled one resumed his work without further remark from the guard. Had the convict persisted in his stubborn attitude, he, no doubt, would have been returned to the prison, a thing most dreaded by one privileged to perform road work.

As examples of interest in the work, the following is mentioned: The prisoner operating a self-propelling street paver on the concrete road, who by the way was incarcerated for taking the part of a highwayman, was asked how he was getting along. The reply was, "all right except my engine is pounding considerably. I will fix it during part of my noon hour." The concrete mixer man on the same job was observed, without his knowledge, to shake his head regretfully when he discharged from the mixer a batch of poorly mixed concrete. General remarks concerning the day's work are heard from time to time expressing regret and satisfaction according to what was accomplished.

These facts are very important from a humanitarian point of view and cannot be disregarded when pure economics are being considered.

MR. ATKINSON (of Louisiana): I would like to ask one question; who was in direct charge of these convicts while at work? Who has the direct supervision and control?

MR. COLEMAN: The representative of the Highway Department, the superintendent or the engineer appointed by the Commission has full control.

MR. ATKINSON: And the captain and guards are under his orders and instructions?

MR. COLEMAN: Yes.

MR. ATKINSON: I want to say that we worked convicts in Louisiana a year and a half or two years, but the captains and guards were employed by the Board of Control and the engineer in charge did not have direct control of them, yet, we got along nicely and did good work; in fact our work cost us under the convict system about 50 per cent or not over 75 per cent, of single work under contract, and it has been proven to my mind that the system of working convicts on road work is very successful and is a very economical way of building roads. Now the cost to maintain these convicts in Louisiana was about 41 cents per man per day; that includes the maintenance of convicts and the guards' salaries and the captain's salary. The reason I asked about who had charge and full control of the convicts is that I believe we could have gotten better results if the Engineering Department had full control of convicts. For instance, the captain may have 3 or 4 flunkies to wait on him and members of the guard would have 3 or 4 flunkies and out of 40 or 50 men there may be 10 or 15 idle to act as flunkies, but nevertheless under the system we have it has been proven to my mind that the convicts can be worked very successfully on road work.

THE CHAIRMAN: Mr. Johnson of Roswell, New Mexico.

MR. JOHNSON: *Mr. Chairman and Fellow Highwaymen:* I am not a highway engineer or road commissioner but I have a bond of relation to these brethren. You heard yesterday of the system of county roads at Charlotte and in Mecklenburg County, North Carolina. My wife's father was the chairman of the Board of Road Commissioners of Mecklenburg County for 30 years and built the first mile of their macadam road, which was the first mile of macadam road built in the South, so while I have no claim to a relationship directly, I have by marriage. I am a minister of the gospel; forced

some years ago to give up the work of an active city pastorate in Chicago by a nervous breakdown and compelled to live outdoors. I found more outdoors in New Mexico than anywhere else and have lived there for the last several years, and being unable to take up the active work of a pastorate, I have given the most of my energies to promoting the gospel of good roads. We have called upon the United States government to help us out of the mud. We have appealed to the boys and girls of our high schools to help us. We are now getting the coöperation of the ladies and I tell you it is time to ask the ministers and priests of this country to enlist in this campaign for good roads. Does not the Good Book say to make the crooked straight and the high places low and the low places high and to make smooth the way of the Lord? It is time that we interpreted that rightly. Does it not say that we live and move and have our being in Him? Well, the moving is pretty tough in some places and therefore good roads have a great deal to do with religion. I want to speak in support of two of the resolutions adopted here today and in the first place I want to show you some apples. These apples were grown a few miles west of Roswell, New Mexico, in the White Mountains, at an elevation of 5750 feet. It is 25 miles from the orchard to the nearest shipping point. The United States government has established the Lincoln National Forest there, has withdrawn the area from settlement and it is impossible for us to tax it to build roads, and those apples have to be hauled most of the 25 miles over federalized areas. Now I am feeding apples like these to the hogs out in Lincoln County, because the United States government has not thus far lifted a finger to improve the roads across its own land. Federal aid in our county means something, but it does not mean what it means in this convention. It means that we frontiersmen out in New Mexico have to aid the United States government to make the roads. Last summer I took my car and three men and went and fixed the impossible places on Uncle Sam's domain in the Lincoln National Forest on my way to my market and shipping point, and I then went over to the next county—I am set behind and before by the government; on one side is this Lincoln National Forest and on the other the Indian reservation—and I went over to O'Terrell County and asked the National Commissioner if they would fix up the worst places on the Indian reservation. It is the worst piece of road on the Southern National Highway which crosses it from here clear across to Santiago, and we have been trying for two years to get the government to appropriate the money to fix that road and they would not do it. So I went over to O'Terrell County got \$1000 of their county road tax and fixed that place on Uncle Sam's Indian reservation. That is federal aid in my county. You have adopted a resolution in which you have joined us in trying to get the United States government to fix up the federalized areas. There are over 200,000,000 acres of land withdrawn from settlement in the United States, mostly

in the West, for Indian reservations, forest reserves and other federal purposes. You can go halfway across the 350 miles east and west across New Mexico, on those federalized areas, and two-thirds of the way across the State of Arizona on them, and if you take the map of the United States and look at those colored areas which show you how much of the great West has been withdrawn from entry for federal purposes, you will see that the adoption of that resolution, if it is carried into effect, will mean the building of thousands of miles of road that are needed on these great through routes to get yonder to the Pacific Coast and on to the wonderland of America, and I want you, when you go home, to take these resolutions, blue pencil them and send them to your representative in Washington and ask them to help us to develop the great West by getting appropriations to build those roads. There is another point I want to emphasize in this stretch of five minutes; I listened here to that magnificent address of Senator Hoke Smith; I listened to that splendid address of the President of the Southern Railway pleading for the market roads from the farm to the nearest market or shipping point; gentlemen, that is true of one-half of the United States, but you may draw a line from Winnipeg down to Bismark, North Dakota, North Platte, Nebraska; Amarillo, Texas; and San Antonio to Corpus Christi, and your map will show you that one-half the area of the United States lies west of that line and the other half east. You can call the eastern half the leaky half of the United States, because it rains so much and agriculture is the main interest; but the western part is the arid or semi-arid West. There are indeed exceptions, there are magnificent valleys like the one in which Roswell is located, with its 600 artesian wells. We have intensive cultivation of the soil, vast alfalfa fields, orchards of apples like these, 40 miles long and a dozen miles wide, but speaking generally, about one-half of the United States depends on mining, upon the live stock industry and upon the presence of the health seekers and the tourists for its prosperity. That happens to be that great West and we are vitally interested in these great through routes that will open up the lines of communication between the older part of the country that we call our home. We want these through routes that the people may come and see and get well and help us develop the magnificent boundless resources of our great West. We say that the United States is looking at this proposition with one eye when it ought to look at it with both eyes. When we find that the United States Office of Public Roads is simply a branch of the Department of Agriculture, we say that the Office of Public Roads should be a department by itself and we should have the through routes that are as essential to the development of our great country as it is that the farmer should have his. We want you to have your roads, that is the thing for Georgia and Iowa and the farming States, but we want you to help us to get our roads that are vital to the development of our country. Gentlemen I thank you.

THE CHAIRMAN: The Committee on Resolutions desire to make a report, after which we will take a recess until 2 p.m.

Mr. W. Tom Winn, Chairman of the Committee on Resolutions, presented the following resolutions which were, on motion, adopted.

FEDERAL COÖPERATION

Resolved, That the American Road Congress emphatically endorse the principle of federal coöperation toward the construction of main highways and thus assist the several States to build the main market roads in the one-half of the country which is devoted to agriculture—and to build through main roads in the one-half of the country which is not predominantly agricultural, but whose prosperity depends upon mining, the raising of live stock, and the presence of the health seeker and tourist.

STATE HIGHWAY COMMISSIONS

WHEREAS, The American Road Congress believes in and has long urged all States to enact uniform road legislation, and

WHEREAS, Experience has abundantly demonstrated that efficiency and economy are not obtained in the construction and upkeep of main roads, except by the coöperation of the States through skilled departments, and

WHEREAS, Forty of the forty-eight States have enacted State legislation; Georgia, Indiana, North Carolina, South Carolina, Tennessee, Arkansas, Florida and Texas, being the exceptions, and

WHEREAS, Federal aid and coöperation is near at hand, and it is probable that States having no highway departments will be unable to participate in such aid, therefore be it,

Resolved, That the American Road Congress in annual convention assembled in the city of Atlanta embracing several thousand delegates representing every State, reaffirm its belief that State Road Departments and State Aid are essential to secure efficiency and economy, and be it further

Resolved, That copies of these resolutions be sent to the governors of all States and to their various highway officials and that they be urged to promptly commend such laws to the legislatures in their respective States.

LINCOLN HIGHWAY

Resolved, That the Lincoln Highway Association be commended for its successful voluntary effort in arranging with counties, cities and townships for a connected series of roads across the United States, thus providing a definite and continuous route to be used wholly or in part by those who wish to become acquainted with the agricultural, mining and scenic advantages of their own land.

PUBLIC SAFETY

Resolved, That the American Road Congress deplore the frequent accidents on the public highways and urge upon the various highway officials or other authorities throughout the United States the enactment of the necessary rules and regulations to insure the public safety.

ROADS IN FEDERAL RESERVATIONS

Resolved, That the federal government be urged to build highways across all Indian and forest reservations and all other federalized areas, where such connecting links are essential parts of established through routes of travel.

COURTESIES

Resolved, That the sincere thanks of the American Road Congress be extended to the State of Georgia, the county of Fulton, the city of Atlanta and to the public press for their active coöperation, generous hospitality, and assistance generally in making this the most successful Road Congress.

November 12, 2 P. M.

DR. JOSEPH HYDE PRATT, CHAIRMAN

THE CHAIRMAN: The first paper on the program this afternoon is "Road Work by the Army," by Major Amos A. Fries, U.S.A.

ROAD WORK BY THE ARMY

MAJOR AMOS A. FRIES

Corps of Engineers, U.S.A.

This subject might be construed in two different ways; first, by the builder, as referring to the construction of roads, and second, by the man on foot, as referring to the use made of the roads. This last view is the one army men will appreciate most. To the weary soldier carrying his bed, board, and weapons, the road he is traveling over is a matter of supreme importance. This importance arises both from a consideration of his own personal comfort, and from his ability or inability, as the case may be, to get into a favorable position for battle.

Rapid marching has saved the lives of many soldiers, and won many battles. Napoleon in his many campaigns was the first great exemplar of this fact, and an able example of it in our own day was Stonewall Jackson's Shenandoah Valley campaign in 1862. Indeed, the Civil War furnished many examples of rapid marches that vitally influenced the fortunes of battles.

And just recently we have had some very brilliant exhibitions of rapid marching in the European War now in progress. The advance of the Germans through Belgium almost to the gates of Paris, as well as their later retreat to the line now held by them furnished a brilliant example of two things: thorough preparation beforehand, and the rapid movement of very large armies. This was true not only of the German armies, but of the French, English and Belgians, both in retreat and on the offensive.

Without good roads such rapid movements of vast armies would have been impossible. And thus again we see another example of how the arts of peace aid in the prosecution of war, or perhaps we ought to put it the other way, how the arts of war make for comfort in peace. Why? Because the first great builders of roads—the Romans—developed the art for the very purpose of moving their armies rapidly to any threatened frontier, and it was from them that the English, French and Germans got their first lessons, and their inspiration for good roads. And here we come to a truth that all we universal peace advocates—which all true army men are—must bear in mind, that is, that almost every art that makes for progress and comfort in peace has its uses in war. This is as true of powder as of roads, of tempered steel as of the clothing we wear on our backs. And until we can persuade the other fellow to abandon all thought of their use for war, we must continue to plan and prepare to use them ourselves in self defense, or else bow to the man who does use them for war purposes. Perhaps you think the statement that all true army men are for universal peace a case of poetic license, but most assuredly it is not.

The most advanced teachers who are fighting the vices that corrupt and kill, including the use of alcoholic liquors, depend upon instilling into the mind, particularly of the young, the horrors of succumbing to the vices they are attacking. Is it any wonder then that the army man with a loving wife and children is for peace, when all his study and observation impress upon him the hell that war is. But slavery, to an independent man, is a worse hell than war, and so the army man prepares for war hoping it may never come, but with the feeling that if the time should come when his country's freedom is menaced he can strike a telling blow for home and fireside.

This is a good deal of a digression from "Road Work in the Army," yet we all need once in a while to stop and realize how much our works built during peace for peaceful purposes will aid us to repel aggression in war, providing we are prepared for war, or if we are not prepared how much the same works may aid an enemy in over-coming us.

Road work in the army! No attempt will be made to outline the history of such work, as this was done in an able manner by Colonel Spencer Cosby, of the Corps of Engineers, in an address delivered before the Second American Road Congress, held at Atlantic City,

New Jersey, October 4, 1912, and published in the proceedings of that Congress, and in the Professional Memoirs, Corps of Engineers, U. S. Army, for July and August, 1914.

Briefly then, the army, and particularly the Corps of Engineers, has been engaged upon various classes of road work from the very beginning of our national life. These roads have varied from the crudest trails constructed under fire in the presence of the enemy to some of the finest roads and streets constructed anywhere in the country. Roads built by army men are found all over the United States, and our foreign possessions—in the tropics, in Cuba, the Philippines and Panama, in the frozen North in Alaska, in the lowlands of our coast, and in the mountains of Yellowstone Park.

As the writer is at present in charge of road work in Yellowstone Park it is believed a brief discussion of that work will prove interesting, since the conditions of work are unique, due to the high altitude of the park, and its location in the midst of the Rocky Mountains right in the path of the storms that, starting from Alaska sweep first southward, and thence eastward across the United States, only to disappear in the storm-lashed Atlantic.

To begin with, there are the tourists—God bless them—who alone make roads in the park a necessity, and who are, to say the least, an awful nuisance to working parties, and the cause of a great increase in cost in many classes of construction. This arises from the fact that the best, and in many cases, about the only working season, coincides with the tourist season. Then too, there are no automobiles, no railroads and no trolleys to facilitate and cheapen the supply and distribution of materials, and for hauling away excavated material of all kinds. Here the horse is supreme! mules, even, being rare.

Every State has its own problems in road construction, as is proper, but Yellowstone Park, being a national institution, would appear to have them all, which, while it may be proper all right, is most disconcerting to the engineer trying to build and maintain roads. Since without money there would be no road problems, and since Congress is the source from which money for Yellowstone Park comes, we will begin there.

The Congressional problem arises from fiscal year appropriations; that is, the money becomes available July 1st, if appropriated before that date, and if not, then, from the date of the appropriation, and must be spent by June 30th the following year or revert to the Treasury. Under ordinary circumstances a year is a year whether beginning in January or July, but circumstances, like everything else in the park, are extraordinary. There are few places where 4 feet of snow will fall in three or four days only to be washed away by 24 to 36 hours of violent thunder showers, and yet that is what happened September 12 to 20, this year.

One year the spring will be early, and work can be begun over most of the park in May and last into November, and the next work

can only be carried on at a few places before June 30, and may be stopped entirely early in October. At the best the winters are long and cold, and thus the second problem is what really makes a problem of fiscal year appropriations. Where work can be carried on for six months one year and only three the next one needs to be an Isaiah to tell what to do. If, as occasionally happens, the appropriation is made later than July 1st, the season is shortened just that much more. That was what happened this year, the season being shortened almost six weeks, and it has been even worse on some previous occasions.

If appropriations were made available until spent the amounts unexpended during a short season could be carried over into a longer one with great economy. As it is now, the engineer must push work in short seasons in bad weather when highly efficient work is impossible, or else turn most of his appropriation back.

Once again, the winters are long and hard, and are usually accompanied with very heavy snow-fall over nearly all portions of the park. In the higher altitudes the ground begins to freeze the last of September, and is often not completely thawed out until late in June of the following year.

As in all mountain roads grades are fairly frequent, and while kept to the minimum in the park there are quite a number of 6 and 8 per cent ones, with many of lesser degree. Due to the heavy freighting in the fall and again early in the spring the snow in the middle of the road is packed down and melted first, thus causing most of the water to run down the middle of the road—a frequent cause of serious injury to the natural soil surfaces that predominate throughout the park.

The tourist season lasts from June 15 to September 20, and this corresponds to the best working season, and in many years to the entire working season. The travel is heavy even in poor years, which naturally interferes greatly with the improvement of existing roads. For instance, every bridge rebuilt requires that it be constructed at a site different from the old one, or else that a temporary bridge be built so teams can get around it. In fact, all road work must be carried on so as not to interfere with the tourist coaches, and since only horses are used, and many grades are steep, with deep canyons on one side, and mountains or walls of rock on the other, extreme care must be used with all machinery and tools that might frighten the animals. In most places this means night work with road rollers and similar machinery, or the abandonment altogether of their use.

Tourists make park roads necessary, and they being mostly natural born Americans have the right to kick if things are not satisfactory, and many avail themselves of the opportunity. It was for this reason that some years ago the government began sprinkling the main traveled roads, and of course once begun it has had to be continued. And it is right too, but nevertheless it is quite a problem

to sprinkle 100 to 130 miles of roads, and do it efficiently on \$15,000 to \$18,000 per year.

If anyone doubts the propriety of sprinkling let him follow a long line of coaches over some hill that is not sprinkled, and if he isn't converted it can only be because he is so optimistic or angelic that his days on earth are numbered.

Oil has been under consideration as a dust preventive for some time, and has been tried a little the past summer, but arrangements to do the oiling were completed very late and only 3 miles of road were oiled. That 3 miles, however, indicated quite clearly that results will not justify the cost unless the roads are shaped and rolled hard just before oiling. Early next spring some gravel macadam will be given an oil and broken stone finish so as to form an oil macadam by the penetration process.

As discussed later the high cost of freight, both outside the park by rail, and inside the park by animal drawn freight wagons makes oiling very expensive as a general proposition. And as if cold weather late in the spring and early in the fall were not bad enough the rapid evaporation caused by an atmospheric pressure of about $11\frac{1}{2}$ pounds per square inch reduces penetration, and may make advisable the use of a lighter oil than has been found best for road work in localities comparatively near sea level. There is no doubt that oil will work successfully on roads in the park, though experiment alone will determine the best kind of oil to use.

As found out in other localities oil on any but macadam of some sort is at best only a temporary expedient, and this brings us to another serious park road problem.

The ancient mariner sang: "Water, water everywhere and not a drop to drink," but the park engineer sighs and says: "Rock, rock everywhere and hardly a stone fit for road surfacing." This is scarcely conceivable in the heart of the Rockies, but it is a sad truth nevertheless. There are long stretches of road where no good rock is found, and where reasonably good gravel is almost unknown. On the other hand, there are a few places where there are unlimited amounts of good stone, but without power vehicles of some sort the cost of freighting metal more than a couple of miles is prohibitive.

The next problem is the large force of engineers, overseers, laborers and teams and the excessive amount of plant required, considering the funds available, all caused by a very short working season. Every construction engineer knows that a new crew works at barely 50 per cent efficiency for the first week or two, and if the crew puts in only seven or eight weeks the cost takes another jump. Furthermore, unless wages considerably above those ordinarily paid outside are offered few good men can be induced to come into the park, and up goes the cost another notch.

The park proper is almost three times as large as the State of Rhode Island, and has very nearly 300 miles of roads, of which 265 may be called main lines. Besides these there are approxi-

mately 100 miles of roads in the Forest Reserve east and south of the park that are more or less improved, and maintained as a part of the park system.

Supervision becomes a serious problem, and as the appropriations allow of the carrying over of only a small force through the long winters second grade foremen and overseers must be taken, or considerably higher wages than those paid elsewhere must be offered as an inducement to good men to come for the summer, and even then the lack of steady employment deters the great majority.

As previously stated, nearly all machinery is handled by teams, and as there is neither forage nor food to be had in the park all men and animals must be subsisted, and as freight is slow and expensive the question of supply alone is a very live issue. The government freight rate in the park is 26.8 cents per ton mile, and as the average distance from railroad connections to working points is 50 miles the cost for freight alone on materials, food products and forage used in the park is approximately \$13.40 per ton. Railroad freight rates outside the park are high, due partly to the lack of both rail and water competition, but more to the distance of the park from centers of manufacture and commerce, the least distance to such centers being about 1000 miles.

As mentioned briefly early in this article the exclusive use of animal transportation in the park has made the use of gasoline or steam driven machinery difficult, and except for minor items the use of power driven machinery and vehicles during the tourist season has to be confined to the night time. While this increases the cost somewhat it is the belief of the writer that the use of such machinery and vehicles should be increased, even if all have to be operated at night.

Unless motor-propelled vehicles are allowed in the park the cost of freighting cannot be materially reduced, and this brings up another question of great interest to the general public and to those engaged in the business of feeding and transporting tourists in the park—that is—whether automobiles shall be allowed to use the park, or whether it shall continue to be kept exclusively for the use of animal drawn vehicles. As this is not an engineering question it will not be gone into further than to say that there are strong arguments on both sides, as anyone will find who studies the question deeply.

The original idea of the park was to keep it as nearly in its natural state as possible, and many feel that motor propelled vehicles would aid in destroying this primitive condition. On the other hand, there is greater speed and comfort in traveling in automobiles, besides the possibility of accommodating a greater number of tourists. However, it is questionable whether the decreased cost in transportation by automobiles over that for animal drawn vehicles will be a great inducement to the traveling public, since the greatest

cost to the average tourist is the railroad expenses incurred in going to and returning from the park.

The total spent on the roads in the park is \$2,425,315.00, of which less than \$3,500 per mile is for construction, the remainder being for maintenance. As park work began over thirty years ago, and as the roads have been kept open for traffic all that time the cost is reasonable for the character of the country through which the roads have been constructed. There are a number of difficult sections where the cost per mile has been many times the average, this of course being made up for in less difficult country. Another factor that must be kept in mind is that the appropriations at first were very small, and in order to build roads to reach the different points of interest they had to be built in the cheapest manner, which usually consisted in cutting out trees and brush, removing boulders and building bridges. Grades are often very steep, and when money became available for better construction these earlier roads had to be abandoned, and of course the money spent on them was lost, except that the public had the use of the old roads during their existence, and were thus enabled to see the park, where otherwise they could not have done so.

In general, it may be said that the present road system is excellent, and the original cost moderate, credit for this being due mainly to two prominent engineer officers of the army, Gen. Dan C. Kingman, Chief of Engineers, and Gen. H. M. Chittenden, retired. To General Kingman is due the credit for originating the idea of constructing a belt line road to connect the various points of interest, and afford means for making a complete circuit of the interesting points without traveling over more than a few miles of road the second time. In the four years General Kingman was in charge of the park roads, 1883 to 1887, appropriations were small, but the system was started, and later ably carried into execution by Gen. H. M. Chittenden.

The roads as built were surfaced with the natural material, such as gravel, earth, or rock nearest at hand, and in general they have served their purpose well.

As the park furnishes some of the most unique classes of scenery found anywhere in the world, and certainly in the United States, and as it is a magnificent summer resort the time seems to have arrived when the government can afford to spend such sums as may be necessary to make the main roads at least into first-class highways.

This is entirely outside of the question whether the roads shall be used for automobiles or be continued for animal drawn vehicles only, since in either case the roads should be first-class. The cost will be considerable for the reasons before mentioned, though judging from past results this cost will not be so very much more than for the same class of roads in localities where nearly everything that is difficult to obtain in the park is close at hand. In this connection it should be said that Congress has been liberal in recent years,

and is showing a desire to put the roads in first-class condition as fast as funds can be spared from the national treasury.

The study of how best to expend these funds is an interesting and serious one, and is being prosecuted with as much speed as natural conditions warrant. The park to any one who has not seen it is a revelation, and as it is a national institution it would seem proper for the writer to urge all those who have not seen it to do so at their earliest convenience, though the roads may not yet be the boulevards that are found in city parks throughout the country.

THE CHAIRMAN: We come now to a subject that is one of the most important in highway work, and that is, the question of contract work. The first paper is by John J. Ryan, Secretary, New York State Road Builders' Association. Mr. Ryan is unable to be present and has delegated the reading of the paper to Mr. T. Hugh Boorman, a highway engineer of New York, and a delegate appointed by Governor Glynn. I have the pleasure of introducing Mr. Boorman, of New York.

MR. BOORMANN: I believe that the time has about arrived when we shall have, as they have in France, a Federal supervision of roads. It is, to my mind, the one safe and proper way of attaining what this country should have, as we have, thank God, everything else of the very best. In reading this paper from Mr. Ryan, I wish to state that Governor Glynn and Mrs. Glynn both would have been very glad to have been with you. Governor Glynn has done excellent work during the short time that he has been the chief magistrate of the State, and it is worthy of much commendation. This question of convict labor he has taken up with excellent results. After these preliminary remarks I will get to the subject of Contract Work. I may say that here I am especially interested, because this paper is on the line of what I claim are constructors and not contractors. Any old bootblack can become a contractor; any fellow that has failed in the shoe business or even in the pulpit can become a contractor and lay cement sidewalks and patent pavements, but, as you will hear from Mr. Ryan's lips, he is a descendant of constructors; you will hear his views, in which I entirely coincide. He uses the word throughout, "real contractors," when I should put "constructors." I think you will see that the term "constructors" is really the more applicable.

POSSIBLE LINES OF IMPROVEMENT IN HIGHWAY CONTRACT WORK

BY JOHN J. RYAN

Secretary, New York State Road Builders Association

Real contractors and real engineers are born not made. A real contractor intuitively knows when, where and how to do the right thing; a real engineer knows how, when and where to plan the right thing to be done. A good contractor, even though tied up to a poor engineer, will be able to worry through and do good work; a first-class engineer, with a green contractor, will be able to complete a contract and show good results at the end, but when an incompetent engineer and a haphazard contractor find themselves on the same job, then there is trouble.

Unfortunately, in the highway contracting business there are a number of careless contractors and incompetent engineers, and for this reason, special attention should be given by States, counties and municipalities toward improving the methods of planning, letting, constructing and completing highway contracts.

Inasmuch as this article will deal with State and county roads, the suggestions will be from the view point of the contractor as to possible improvement in connection with State and county highway contracts.

When it has been decided by the officials of any State or county to build, or to improve a highway, the first step is to have a preliminary survey made, in order to ascertain the cost, so as to arrange for an appropriation covering the proposed improvement.

In the past it has been the general idea that a preliminary survey was merely an order from the Highway Department to send out a crew of young engineers on a cross country run. When this crew of sprinters started out on their preliminary survey they were allowed so many days, and generally this time allowance was so short that when the crew reached the road, the survey resolved itself into one hundred yard dashes with hurdles thrown in. There was so much surface skimming done that when the note-books made up by these engineers were returned to the office, they were found full of inaccuracies.

No time was spent by this marathon crew in seeking out information as to soil conditions, bad drainage, water flow of streams, property lines, deposits of road making materials, kind and amount of traffic, type of feeder roads, or any of the conditions which might have some effect on the selection of the proper type of road to suit that locality. Many a highway contract has been let where the type of road called for local materials, and no information has been given as to where these materials might be found in an acceptable quality. Special attention should be given by the survey party,

and it would well repay the Highway Departments, to see that these deposits of materials be sought out and properly located, in order that a correct estimate be made of the cost of the road. With a full and complete preliminary survey, the highway officials would be in a position to select the proper type, make an accurate estimate of the cost, furnish the bidders with detailed information concerning the materials to be used, and arrange to take care of the conditions affecting the life of the road; in short, cut the cloth to fit the form.

More roads go to pieces on account of poor judgment in the selection of type of road, than by poor workmanship on the part of the contractor. Yet, when one of these carelessly selected unfit types of road disintegrates, everybody jumps on the contractor and the engineer, even when they have followed the specifications to the letter.

When it has been decided to have a highway contract letting, the Department should consider seasons for such lettings. The late fall, winter and early spring are the best, inasmuch as the contractor has practically closed up his work, and has plenty of time to go over new jobs, and be in a position to bid intelligently on these contracts. The State or county would gain more by having lettings at these times, as they would receive more bids and, undoubtedly, fairer prices for work.

In connection with the letting of roads there seems to be a reluctance on the part of most Highway Departments to furnish information to bidders. Never yet has a State or county lost money by allowing a contractor to know in advance all that there was to be known about a contract which was advertised for letting. In New York State it has been the practice, after advertising highway contracts, to furnish the contractors with the engineer's figures showing how the engineer has arrived at his estimate by computing basic prices, with profit allowance. While some of the Old Guard of contractors state that they prefer no engineer's estimates to be given, yet, in general, the road builder in New York State looks for these estimates on each road, and checks up the same with his own idea of cost prices, making allowance for methods and supervision. It has yet to be found that the State of New York lost any money by this procedure; rather has it benefited by it, because the contractor when furnished with full information as to the contract, is in a position to bid closer and know what he is doing when bidding. This idea of giving the contractor every assistance possible before the letting, has brought about the circulation of tabulated sheets which show the item prices on each contract, and also state the amount of appropriation and amount of engineer's estimate. These tabulated sheets are of great help to the material and machinery men, and inasmuch as the shipping points are shown, the contractors are not guessing at the cost of imported materials, but have their quotations from the supply or machinery men days before the letting occurs.

On the day appointed for the letting, the bids should be in at a specified hour, and opened at that time and read publicly; reading every item, and also the total amount of contract price. This practice advised the contractor immediately whether his is a low bidder or not, and he is in a position to make arrangements about plant, materials and labor, pending the official award. This award should not be held up more than twenty-four hours, unless for some unforeseen cause. It ought not to take over twenty-four hours to make a recapitulation of any number of highway bids. In New York State, where on one day they have as many as thirty roads with three hundred bidders, the checking up is done at the same time the bids are read, and the award is made that day or the next morning. This allows the contractor to arrange for his bonds and the other necessities in connection with the preliminary part of his contract.

Performance bonds for highway contracts should not be over 50 per cent of the contract price. These bonds become a liability when the contractor signs them, and while it may be called paper liability, yet it has effect upon his credit and sometimes acts as a hindrance in securing other contracts. In some States they ask for a bond of 100 per cent, which is quite needless, and an inheritance of old and obsolete requirements. When a contract and bond have been signed by the contractor, and filed and approved by the proper highway officials, the contractor is generally ready to start things. He wants to be moving. It is not natural for the contractor to be hanging around the office. His work is energetic, and he wants to be doing something. This is the time where the accurate preliminary survey will show that certain materials have been tested and some found acceptable. The location of these acceptable materials designated, Mr. Contractor is now in a position to locate his machinery, make up his organization and get ready to start his job. Just before he gets this job started, however, it is necessary for the Department to have a representative on the work, and this representative must have some consideration. He is the mouthpiece for the Highway Department, and care should be taken in his selection, so that this mouthpiece be neither dumb, tongue tied nor voluble.

The growth of highway construction in United States has been so great, it has been almost impossible to find enough engineers who have a practical knowledge of road construction. For the most part, the road engineers are school boys plucked from technical schools and from civil service examinations, without an idea of practical road building, and sent out on the job armed with a book of specifications and set of blue prints. These young men are apt to be so afraid of themselves on account of their inexperience, they generally are so stiff that they lean backward. If there could only be a sort of preparatory school for young engineers who have been appointed to the Highway Department, and these engineers could

be given a few months of drilling in common sense interpretation of specifications, and then sent as assistants to old, practical engineers, who would be able to show them by their good example, that the engineer on the highway job is not supposed to be a detective, but an advisor and director, then there would be less friction and more and better roads built.

The accumulation of useless and obsolete machinery by the road contractor is one of the curses of the road building business. Every change of administration, every change of highway officials, brings about some new type of road advertised without any test or experiment. The contractor who secures it, finds that when he is ready to start work, he must go out and buy this or that kind of machinery, when he already has carloads of machinery rusting and falling away in some storehouse or yard. It is hoped by the active road builder, that some day there will be a millenium, when the types of roads will be settled upon, and everything standardized so that the machinery that is used in building them may be standardized also, and the contractor not put to the continued expense of buying new machinery and throwing away the old. The depreciation of machinery is big enough without having a loss on account of the constant changes in types of construction.

Suppose the contractor with a contract on his hands has worked his way through the initial stages, by locating his plant and organization on the job; suppose he has met his engineer, with the hope that he will find him of some breadth and capacity; suppose work is started and the machinery put in operation, and everything running smoothly; then comes some little question as to the interpretation of the specifications, here your Mr. Road Engineer, if he be one of those near-sighted, hair splitting, afraid-of-his-life young men, he will get so fine in his decisions that he will forget all about the fact that he is building roads, and will try to build watches. These watch builders are the bane of highway construction. Never yet was a road built by a watch builder. A road has to be built by a road builder. You cannot have hair line decisions on road work. No blame for this can be applied to the Highway Departments. The trouble is the dearth of good, practical and competent road engineers. The failure of an engineer on the job, to make timely decisions in reference to materials or questions that come up in the course of construction, has brought about losses in highway construction, not only to the contractor, but to the Department.

The monthly estimate is the vital thing to the contractor. There can be no successful contract without prompt monthly estimates. They must not be irregular or pruned. Monthly payments to the builder are as food to the body.

In some States 90 per cent of the monthly estimates taken about the twentieth of the month are paid before the first of the next month, that is, practically all monthly estimates are paid within ten days. That is a fact, and records in the New York State High-

way Department will show these statements to be true. If New York State can do it, other States can do it. It only means, make the engineer keep up to his job, and make the contractor keep up to his.

When the first monthly estimate comes around the contractor, if he is a real, live contractor, will have his cost data and his monthly reports figured so that he knows how much work has been done, and how much it has cost him, and he is then in a position to take up the matter with the engineer. Together they can check up and agree upon what the estimate should be, so that there will be no deficiency when the check comes to the contractor. Every contractor should keep accurate account, by daily time reports, of every one on his payroll, of the time and amount of work done. Only in this way can he keep tabs on his job and be in a position to put up a fight for what is his when the estimate time comes around.

If more attention was paid by road builders to cost data, there would be fewer disagreements with engineers about how much was coming to them. The right kind of an engineer is only too glad to check up with the right kind of a contractor. Of course, there are exceptions where this checking might lead to some wrong doing, but today, this is almost impossible, and on good straight contract work the final estimates would show over-paying and would bring out the fact that there had been collusion. Item prices and publicity tend toward minimizing the chances of collusion between the engineer and contractor.

When it comes to the completion of a highway contract there should be no delay in its acceptance. The engineer should follow the contractor's work with his final cross sections, and be ready to send in the final quantities, in order to pave the way for speedy payments.

One of the great drawbacks to the highway contracting business is the long delay in final payments on roads. The contractor is sometimes held up for months, and in addition to the 10 or 15 per cent of retained money, there is generally the last monthly estimate. This is apt to have a contractor tied up and his credit questioned by banks, material and machinery men. The margin of profit is too small to allow of long deferred final payments. The contractor is advancing most of the money, and with the large retained percentages, he is handicapped in arranging for new work, and paying off the liabilities which have accumulated on the previous contract.

Up to a short time ago, it was the practice in several States for the engineers out on highway work during the summer, to hold back their final cross sections and quantity sheets until they were called into the main office for winter work. They hung on to these estimates like grim death in order to string out their time during the winter. Mr. Road Contractor was wearing a path to the Highway Department trying to get the money due him. This was unfair to the contractor, and to those depending upon him for payment of accounts.

The road builder who knows that his final moneys will be paid to him within thirty or sixty days after the acceptance of his contracts, is in a position to do better work and at a little less money than the man who is paying interest notes in the banks, and on notes to machinery men, and having a hard time to meet the payrolls on other work.

In some States the Highway Department has made a record in the way they have handled these final payments, and the contractors in these States are the best in the business. It is a fact that when the Highway Department tries to help the contractor, the contractor is there to help the Department.

Contractors do not get together as often as they ought. Road officials and engineers have conventions, State and national. No body of men engaged in the same line of business ever assembled without some good coming to the individuals. Exchange of ideas in reference to methods of supervision, operation of machinery, manipulation of materials, etc., is bound to help the practical end of road building.

Highway contracting today is an industry large and extensive. It will be greater in the coming years. The interest in good roads in States just awakening, is going to mean more highway contracts, more highway contractors, and more highway engineers. Highway improvement is being benefited by the interest shown in it by the public; and it is by such conventions as this, where officials, engineers and contractors discuss subjects of common interest, that improvement along standard lines of highway contract work will be secured.

DISCUSSION OF POSSIBLE LINES OF IMPROVEMENT IN HIGHWAY CONTRACT WORK

L. D. SMOOT

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Real contractors and real engineers are born not made. A real contractor intuitively knows when, where and how to do the right thing; a real engineer knows how, when and where to plan the right thing to be done. A good contractor, even though tied up to a poor engineer, will be able to worry through and do good work; a first-class engineer, with a green contractor, will be able to complete a contract and show good results at the end, but when an incompetent engineer and a haphazard contractor find themselves on the same job, then there is trouble.

Unfortunately, in the highway contracting business there are a number of careless contractors and incompetent engineers, and for this reason, special attention should be given by States, counties and municipalities toward improving the methods of planning, letting, constructing and completing highway contracts.

Inasmuch as this article will deal with State and county roads, the suggestions will be from the view point of the contractor as to possible improvement in connection with State and county highway contracts.

When it has been decided by the officials of any State or county to build, or to improve a highway, the first step is to have a preliminary survey made, in order to ascertain the cost, so as to arrange for an appropriation covering the proposed improvement.

In the past it has been the general idea that a preliminary survey was merely an order from the Highway Department to send out a crew of young engineers on a cross country run. When this crew of sprinters started out on their preliminary survey they were allowed so many days, and generally this time allowance was so short that when the crew reached the road, the survey resolved itself into one hundred yard dashes with hurdles thrown in. There was so much surface skimming done that when the note-books made up by these engineers were returned to the office, they were found full of inaccuracies.

No time was spent by this marathon crew in seeking out information as to soil conditions, bad drainage, water flow of streams, property lines, deposits of road making materials, kind and amount of traffic, type of feeder roads, or any of the conditions which might have some effect on the selection of the proper type of road to suit that locality. Many a highway contract has been let where the type of road called for local materials, and no information has been given as to where these materials might be found in an acceptable quality. Special attention should be given by the survey party, and it would well repay the Highway Departments, to see that these deposits of materials be sought out and properly located, in order that a correct estimate be made of the cost of the road. With a full and complete preliminary survey, the highway officials would be in a position to select the proper type, make an accurate estimate of the cost, furnish the bidders with detailed information concerning the materials to be used, and arrange to take care of the conditions affecting the life of the road; in short, cut the cloth to fit the form.

More roads go to pieces on account of poor judgment in the selection of type of road, than by poor workmanship on the part of the contractor. Yet, when one of these carelessly selected unfit types of road disintegrates, everybody jumps on the contractor and the engineer, even when they have followed the specifications to the letter.

When it has been decided to have a highway contract letting, the department should consider seasons for such lettings. The late fall, winter and early spring are the best, inasmuch as the contractor has practically closed up his work, and has plenty of time to go over new jobs, and be in a position to bid intelligently on these contracts. The State or county would gain more by having

lettings at these times, as they would receive more bids and, undoubtedly, fairer prices for work.

In connection with the letting of roads there seems to be a reluctance on the part of most Highway Departments to furnish information to bidders. Never yet has a State or county lost money by allowing a contractor to know in advance all that there was to be known about a contract which was advertised for letting. In New York State it has been the practise, after advertising highway contracts, to furnish the contractors with the engineer's figures showing how the engineer has arrived at his estimate by computing basic prices, with profit allowance. While some of the old guard of contractors state that they prefer no engineer's estimate to be given, yet, in general, the road builder in New York State looks for these estimates on each road, and checks up the same with his own idea of cost prices, making allowance for methods and supervision. It has yet to be found that the State of New York lost any money by this procedure; rather has it benefited by it, because the contractor when furnished with full information as to the contract, is in a position to bid closer and know what he is doing when bidding. This idea of giving the contractor every assistance possible before the letting, has brought about the circulation of tabulated sheets which show the item prices on each contract, and also state the amount of appropriation and amount of engineer's estimate. These tabulated sheets are of great help to the material and machinery men, and inasmuch as the shipping points are shown, the contractors are not guessing at the cost of imported materials, but have their quotations from the supply or machinery men days before the letting occurs.

On the day appointed for the letting, the bids should be in at a specified hour, and opened at that time and read publicly; reading every item, and also the total amount of contract price. This practice advised the contractor immediately whether his is a low bid or not, and he is in a position to make arrangements about plant, materials and labor, pending the official award. This award should not be held up more than twenty-four hours, unless for some unforeseen cause. It ought not to take over twenty-four hours to make a recapitulation of any number of highway bids. In New York State, where on one day they have as many as thirty roads with three hundred bidders, the checking up is done at the same time the bids are read, and the award is made that day or the next morning. This allows the contractor to arrange for his bonds and the other necessities in connection with the preliminary part of his contract.

Performance bonds for highway contracts should not be over 50 per cent of the contract price. These bonds become a liability when the contractor signs them, and while it may be called paper liability, yet it has effect upon his credit and sometimes acts as a hindrance in securing other contracts. In some States they ask for a bond of 100 per cent, which is quite needless, and an in-

heritance of old and obsolete requirements. When a contract and bond have been signed by the contractor, and filed and approved by the proper highway officials, the contractor is generally ready to start things. He wants to be moving. It is not natural for the contractor to be hanging around the office. His work is energetic, and he wants to be doing something. This is the time where the accurate preliminary survey will show that certain materials have been tested and some found acceptable. The location of these acceptable materials designated Mr. Contractor is now in a position to locate his machinery, make up his organization and get ready to start his job. Just before he gets this job started, however, it is necessary for the department to have a representative on the work, and this representative must have some consideration. He is the mouthpiece for the Highway Department, and care should be taken in his selection, so that this mouthpiece be neither dumb, tongue-tied nor voluble.

The growth of highway construction in United States has been so great, it has been almost impossible to find enough engineers who have a practical knowledge of road construction. For the most part, the road engineers are school boys plucked from technical schools and from civil service examinations, without an idea of practical road building, and sent out on the job armed with a book of specifications and set of blue prints. These young men are apt to be so afraid of themselves on account of their inexperience, they generally are so stiff that they lean backward. If there could only be a sort of preparatory school for young engineers who have been appointed to the Highway Department, and these engineers could be given a few months of drilling in common sense interpretation of specifications, and then sent as assistant to old, practical engineers, who would be able to show them by their good example, that the engineer on the highway job is not supposed to be a detective, but an adviser and director, then there would be less friction and more and better roads built.

The accumulation of useless and obsolete machinery by the road contractor is one of the curses of the road building business. Every change of administration, every change of highway officials, brings about some new type of road advertised without any test or experiment. The contractor who secures it, finds that when he is ready to start work, he must go out and buy this or that kind of machinery, when he already has carloads of machinery rusting and falling away in some storehouse or yard. It is hoped by the active road builder, that some day there will be a millennium, when the types of roads will be settled upon, and everything standardized so that the machinery that is used in building them may be standardized also, and the contractor not put to the continued expense of buying new machinery and throwing away the old. The depreciation of machinery is big enough without having a loss on account of the constant changes in types of construction.

Suppose the contractor with a contract on his hands has worked his way through the initial stages, by locating his plant and organization on the job; suppose he has met his engineer, with the hope that he will find him of some breadth and capacity; suppose work is started and the machinery put in operation, and everything running smoothly; then comes some little question as to the interpretation of the specifications, here your Mr. Road Engineer, if he be one of those near-sighted, hair splitting, afraid-of-his-life young man, he will get so fine in his decisions that he will forget all about the fact that he is building roads, and will try to build watches. These watch builders are the bane of highway construction. Never yet was a road built by a watch builder. A road has to be built by a road builder. You cannot have hair line decisions on road work. No blame for this can be applied to the Highway Departments. The trouble is the dearth of good, practical and competent road engineers. The failure of an engineer on the job to make timely decisions in reference to materials or questions that come up in the course of construction, has brought about losses in highway construction, not only to the contractor, but to the departments.

The monthly estimate is the vital thing to the contractor. There can be no successful contract without prompt monthly estimates. They must not be irregular or pruned. Monthly payments to the builder are as food to the body.

In some States 90 per cent of the monthly estimates taken about the twentieth of the month are paid before the first of the next month, that is, practically all monthly estimates are paid within ten days. This is a fact, and records in the New York State Highway Department will show these statements to be true. If New York State can do it, other States can do it. It only means, make the engineer keep up to his job, and make the contractor keep up to his.

When the first monthly estimate comes around the contractor, if he is a real, live contractor, will have his cost data and his monthly reports figured so that he knows how much work has been done, and how much it has cost him, and he is then in a position to take up the matter with the engineer. Together they can check up and agree upon what the estimate should be, so that there will be no deficiency when the check comes to the contractor. Every contractor should keep accurate account, by daily time reports, of every one on his payroll, of the time and amount of work done. Only in this way can he keep tabs on his job and be in a position to put up a fight for what is his when the estimate time comes around.

If more attention was paid by road builders to cost data, there would be fewer disagreements with engineers about how much was coming to them. The right kind of an engineer is only too glad to check up with the right kind of a contractor. Of course, there are exceptions where this checking might lead to some

wrong doing, but today, this is almost impossible, and on good straight contract work the final estimates would show over-paying and would bring out the fact that there had been collusion. Item prices and publicity tend toward minimizing the chances of collusion between the engineer and contractor.

When it comes to the completion of a highway contract there should be no delay in its acceptance. The engineer should follow the contractor's work with his final cross sections, and be ready to send in the final quantities, in order to pave the way for speedy payments.

One of the great drawbacks to the highway contracting business is the long delay in final payments on roads. The contractor sometimes held up for months, and in addition to the 10 or 15 per cent of retained money, there is generally the last monthly estimate. This is apt to have a contractor tied up and his credit questioned by banks, material and machinery men. The margin of profit is too small to allow of long deferred final payments. The contractor is advancing most of the money, and with the large retained percentages, he is handicapped in arranging for new work, and paying off the liabilities which have accumulated on the previous contract.

Up to a short time ago, it was the practice in several States for the engineers out on highway work during the summer, to hold back their final cross sections and quantity sheets until they were called into the main office for winter work. They hung on to these estimates like grim death in order to string out their time during the winter. Mr. Road Contractor was wearing a path to the Highway Department trying to get the money due him. This was unfair to the contractor, and to those depending upon him for payment of accounts.

The road builder who knows that his final moneys will be paid to him within thirty or sixty days after the acceptance of his contracts, is in a position to do better work and at a little less money than the man who is paying interest notes in the banks, and on notes to machinery men, and having a hard time to meet the payrolls on other work.

In some States the Highway Department has made a record in the way they have handled these final payments, and the contractors in these States are the best in the business. It is a fact that when the Highway Department tries to help the contractor, the contractor is there to help the department.

Contractors do not get together as often as they ought. Road officials and engineers have conventions, State and national. No body of men engaged in the same line of business ever assembled without some good coming to the individuals. Exchange of ideas, in reference to methods of supervision, operation of machinery, manipulation of materials, etc., is bound to help the practical end of road building.

Highway contracting today is an industry large and extensive. It will be greater in the coming years. The interest in good roads in States just awakening, is going to mean more highway contracts, more highway contractors, and more highway engineers. Highway improvement is being benefited by the interest shown in it by the public; and it is by such conventions as this, where officials, engineers and contractors discuss subjects of common interest, that improvement along standard lines of highway contract work will be secured.

Mr. Shirley takes the chair.

THE CHAIRMAN: The subject of the next paper is Highway Engineering Education, by Prof. C. M. Strahan, Dean of Engineering, University of Georgia. It gives me pleasure to introduce Professor Strahan.

HIGHWAY ENGINEERING EDUCATION

C. M. STRAHAN

Dean of Engineering, University of Georgia

A friend of mine from Muscogee County, said to me that the three fundamentals of building good roads were a negro, a mule, and brains. I take it that we are now concerned with the question of the kind of brains required and how to get them. The universities are regarded as the chief brain factories of the country. We naturally look to them for road building brains—what can they supply? Or rather what ought they to supply? By adopting the military analogy we may possibly classify the answer. The army needs the brains of the general, of the major, of the lieutenant, of the non-commissioned officer, of the private—it needs them for infantry, for cavalry, for artillery.

We cannot expect West Point to turn out ready made generals—we are content to accept second lieutenants. We cannot tell which of these lieutenants is going to be the ultimate general, or whether his future will run to infantry, cavalry, or artillery. We do know that experience must be added to early training before the finished product will be wrought.

So in regard to the education of highway engineers, the university must direct its undergraduate effort to making the well drilled sub-officer rooted and grounded in the fundamental truths of his profession capable by opportunity and experience of serving in a specific arm of the service and growing more and more into perfect power as the result of that experience and his personal initiative. The West Point graduate is not a specialist in infantry maneuvers, in cavalry evolutions, artillery ballistics. He has been taught the principles and chief practices of them all. He specializes afterward. His ultimate efficiency as a higher officer lies in his ability

to direct his energy wisely in relation to the whole army and to the exigencies of that part of the fight in which he is actually engaged.

The young highway engineer enlists in one grand division of the great civil engineering army. He is required to serve in one company of this division. He hopes for promotion. Manifestly his training should be broad enough to include not simply the work of his company but of his whole division. But even then suppose he is a misfit! He may properly belong to the Sanitary Corps. The university must bear this in mind, both for him and for the highways. It must remember that the item of experience, the item of personality, powerfully modify the quality of brain product. Fortunately justice can usually be done to both sides if a too narrow undergraduate training is avoided. There underlies the whole field of civil engineering knowledge a limited number of sound physical, mathematical and chemical ideas. To select and emphasize these fundamentals, to vitalize them by an adequate but too multiplied number of variety of practical applications is the real problem of the engineering school.

The same kind of moments and shears are at work in the highway bridge as in all bridges. The construction details differ. A limited number of typical bridge designs, not every possible design, has place in the undergraduate course. The same principles of drafting cover the railroad map, the architect's plans and the highway lay-out. The same principles of mathematics apply to quantitative estimates whether of masonry, or water, or earth work. The natural properties and suitabilities of stone, of brick, of cements and concretes, of sand, of clay, of metals, are fundamental to the selection for structural use of any kind. The special adaptability of each or in combination is perfected in the engineer by research and structural experience. The university can here give valuable partial demonstrations and data up to a certain point. It can reveal the laboratory point of view through experiments and tests on the more important materials. The engineering experiment station and testing laboratory with their trained specialists must continue this research work.

The broad principles and significant facts of hydraulics are also fundamental to the highway engineer as to any other engineer. Let him understand these principles and he will readily grasp the coasting of his road surfaces, the undermining of his bridge piers, the capacities of his side ditches and culverts. The writer forbears to press this line of thought further.

Engineering efficiency of the individual then consists:

1. In broad and firm grasp of the physical, chemical, quantitative and qualitative relations of natural and manufactured materials and of the forces at work on them.

2. The utilization and management of men, of motive power, of machinery to accomplish definite structural ends with these materials.

There are three principal things to be done:

1. Certain field operations in laying out the proposed work.
2. Certain office drawings and calculations to make clear the purpose and the construction contemplated.
3. The actual performance of the construction by the best agencies and materials.

The university can give insight into materials of important kinds, it can give training in typical surveys, in office drawings, in mathematical calculations, in principles of design and in theories of the action of forces. It cannot give experience and judgment in the control of labor or the final economics of motive power and machinery. The writer would therefore be content to turn out highway second lieutenants with the possibility of their becoming by experience, majors in earth roads, colonels in concrete roads and chiefs of staff on highway commissions. He would rely on the graduate school, the research laboratory and the field construction, to effect the successive promotions from grade to grade.

He would avoid the inadequate foundation in the young highway engineer's mental training as zealously as in the road he is expected to construct.

THE CHAIRMAN: Gentlemen, I have the pleasure of introducing Mr. D. J. Morrison, of Mississippi.

MR. MORRISON: Gentlemen, I have the honor to represent as chairman, the Mississippi delegation to this convention appointed by our governor.

The thought has come to my mind by the speeches and the general type and character of the delegation represented here that the momentous question before this Congress and the American people is transportation and its methods.

Without transportation the past would be forgotten, the present grow dim, and the future be blotted out. Transportation is the connecting link between sorrow and happiness, between failure and success, between ignorance and intelligence, between darkness and light, between heathenism and civilization, between despair and hope, between war and peace and between death and life. Transportation first led our primitive ancestor from his benighted hut along a stony footpath to the brook for water, or over the bosom of some lonely lake in his boat of bark or skin in quest of food to the great double track trunk railway lines of today, or to the mighty steamships that traverse the seas and touch all the remotest lands of the world. Transportation transformed the call of communication of this ancestor of ours to his neighbor across the brook to the wireless voice of the Marconi system of telegraphy heard now across the oceans and seas by every land of the globe. Transportation transformed the falcon or the carrier pigeon to the armoured airships of today. In proportion as the method of transportation is intensi-

fied its use is diminished. Wireless telegraphy is the most intense physical mode of transportation and closely approaches the swiftness and speed of human thought. Wireless telegraphy, airships, waterships, telephones, telegraphs, electric and steam railways all are intensified methods of transportation, and in their use are more or less diminished in comparison to the great public highways of our country upon which the masses must depend for their mode of transportation, and over which must be transformed from the fields food and clothing to the teaming millions of the world.

Is it not amazing and incomprehensible with such a stupendous factor as good roads to increase the wealth of our nation, and raise the standard of our citizenship to such a high efficiency our Federal Government has done so little to aid this department. Why should not Congress long ago ranked the department of public highways among the first of importance of her economic questions. I say this is strange and incomprehensible when Congress has done so much and spent so much money in other ways. Can any appropriation develop greater resources and wealth or reach a greater number of people than the farmer who holds the real wealth of the nation, than an appropriation for improving country highways?

Congress appropriates large sums annually for building and maintaining levees, harbors, canals, and railroads, and still other large sums to protect our health in the pure food act, in the quarantine act to protect us from outside competition in the tariff act, to protect us from extortion, transportation rates in the interstate commerce act. Much money is spent by other acts, namely—to teach us how to grow two blades of grass where one grew, two ears of corn where one grew, two bales of cotton where one grew, how to kill the lady-bug, the potato bug, the Egyptian moth, the boll weevil, and many other acts looking to protect and better the condition of the farmer. The Federal Government pays large sums to railroad companies for transporting the mail over their roads, yet, how many dollars are paid by the Federal Government for building and maintaining public roads over which thousands of tons of mail is transported daily by the parcel post and rural delivery routes. This seems that the Federal Government has subsidized our public roads and appropriated their use for the mail service without paying a dollar for the privilege to the country through which they pass. To the contrary the United States claims the supreme right of way over them.

Our congressmen and senators are directly responsible for these inequalities of rights and benefits and the representatives of our legislature are under the same indictment.

The solution of building good roads throughout the length and breadth of this country is in the hands of the people, and especially the farmer, who has always been the idol and hero of the politicians' campaign, until the election is over. Let the eternal question burn its way into the legislature and Congress by the voters, "Will you if

elected support State and national aid for public highways." When this is done we will be sure to get this all important aid.

The Southern States need good roads more now than ever, since cotton has ceased to be the wealth of our crop, on account of the boll weevil.

A bale of cotton under normal conditions is worth \$50.00 and weighs 500 pounds. To equal this value of \$50.00 in native hay we have a weight of 10,000 pounds, and in corn a weight of 6,000 pounds. Forced to largely abandon raising cotton we must raise products of higher tonnage, and the transportation of this high tonnage is the factor that demands immediately a larger field of improved highways for the South.

A Mississippi highway association growing out of this Congress among the delegates appointed by Governor Brewer has been formed, and I have the honor of being its president, and I hope that when our next legislature meets you will find Mississippi transferred from the delinquent list and among those States who have a Highway Department.

Gentlemen, as chairman of the Mississippi delegation I submit to you the following report of what our State has done in four years even without a public highway department from which I could gather data. This report does not include work done by tax levy, but only that by bond issue.

Amount of money raised by bond issue	\$5,920,500.00
Number of miles of gravel roads built.....	717.41
Number of miles of macadam roads built.....	137.13
Number of miles of sand, clay and dirt roads built....	5381.00
Number of miles of concrete roads built.....	31.00
Number of miles of different kinds of roads now under contract.....	3272.00
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	9518.54
Approximate amount of money on hand for future contract or uncompleted contracts.....	<hr/>
	\$1,139,500.00

THE CHAIRMAN: Continuing the subject of highway engineering education, I now have the pleasure of introducing Prof. Hector J. Hughes, Chairman of the School of Engineering, Harvard University.

PROFESSOR HUGHES: Engineering education is usually taken to mean the technical education comprised in a limited period of four years, more or less, pursued at a scientific school or college; and it is my conviction that many of the difficulties which confront us in connection with this subject are due to a point of view which leads us to look upon this period, which is only a short step in the process of education, as its end and goal. Moreover, although engineers and administrators and engineering teachers know pretty well

what is essential and desirable for young students intending to enter upon highway work, there is a considerable divergence of opinion as to the best way to organize instruction; and there are also many limitations imposed upon the technical schools by factors and influences beyond their control.

We are at present confronted with a demand for trained highway engineers much larger than the supply. This is partly because the field is new, and experienced men are relatively scarce, and partly because the engineering schools have not developed their highway work as well as older subjects of instruction. Moreover, this very lack of experienced highway engineers, accentuates the deficiencies of young graduates when they enter this field because they are, at the beginning of their careers, called upon for a degree of skill and knowledge of practice which is to be gained only by experience, and to fill places which in other fields are commonly held by older men. We should meet the immediate demands thoroughly, and train our students to profit by this present opportunity; but we should not forget that the condition is abnormal, nor embark upon educational policies which may result, sooner or later, in conditions which may be disadvantageous to the engineers themselves, as well as to the community which they serve.

We too often discuss engineering courses as if the education of engineers were comprised in the short period spent in a technical school, and plan the subjects of study as if young graduates were finished products. If they often fall into that fatal mistake themselves, they are hardly to be blamed; yet we know right well that they are only beginners in their profession, that their education begins with their first mental impressions in infancy, that their character and their habits of work and thought are more or less determined before they enter college, and if their education is to end when they graduate, as sometimes happens, time and money and effort have been wasted in starting them on ineffectual and disappointing careers.

It is not too much to expect that young engineering graduates should leave the technical schools mentally equipped to enter upon practice in any one of the several closely allied fields of work, with the expectation that continued further study combined with experience will lead to expertness and suitable rewards. When there were only a few special fields of engineering, the task of the schools was simple, but with the growing and inevitable development of specialties, the schools are facing difficult problems in trying to meet the demand for more specialized training without sacrificing subjects which are commonly held to be both fundamental and indispensable. The problem reduces itself in the last analysis, to the best use of time and money; the time required to complete not only a technical course, but also the whole course of schooling, the money spent in providing educational opportunities, and in supporting students a considerable period of their life in unproductive effort.

Engineering students of this country rarely carry their schooling beyond the four-year undergraduate courses of the engineering schools. A small percentage of our engineering students go to college before entering upon their professional studies, another small percentage take an additional year or more of advanced specialized engineering work; this small but important class should be well provided for, but the four-year undergraduate courses are our chief concern.

The average age of entrance to the technical schools is probably between 18 and 19 years, and the age of graduation between 22 and 23 years; and the four years in the schools comprise in reality only four periods of about thirty weeks each, with perhaps an additional ten weeks in the summer, making the whole period specifically devoted to what we call a technical training, about one hundred and thirty weeks, or two and a half full years. About one-half of this period is allotted to subjects which are not technical, although many of them are necessary preparation for applied science or engineering subjects which we are accustomed to look upon as the real technical training. In these four years, or to be more exact two and a half years, students are expected to become intelligent observers, industrious, clear and logical thinkers; to learn to express themselves correctly and clearly in speech, in writing and in drawing; to acquire skill in the use of mathematics and mechanics; to get a fundamental knowledge of four or five physical sciences and be trained in laboratory methods; also to become thoroughly grounded in the applied sciences (that is, the engineering subjects of one general field of engineering), and to acquire some skill in the use of engineering instruments. To this is usually added the study of one or two foreign languages, sometimes economics, literature and history.

As highway engineers, they should learn of the materials, processes and methods used in all kinds of roads and pavements; they should be trained in making physical and chemical tests of road materials, and interpreting these tests; they should be trained in location and design, in writing specifications; and should know something about road economics and administration, and road laws, and be familiar with good practice in general.

It is only necessary to enumerate these subjects to show that the proper accomplishment of all the training desirable is not possible within the limited period available. The necessary stress under which the students work often defeats the very object of their education, namely, a thorough training of the mind.

The technical schools have met the demand for specialization in several ways. (1) By establishing advanced graduate courses which recognize the fact that to be effective, specialized work should be based upon thorough training in fundamentals. Such courses are naturally only available for those who have completed the undergraduate work. While this method solves the problem for

those few who can afford the time and money, it does not solve the problem for the average student. There should be a few schools well equipped and well manned to provide this class of instruction for very promising men, and for those who wish to return from practice to acquire additional special knowledge in the fields into which choice or circumstances have placed them. But it is not a general solution, even if students could accept it, certainly not unless it could be accomplished without increasing the age of graduation, which is very high at the present time.

(2) A second method is to add to the technical programs, courses giving the salient points of special fields, as the demand for one after another arises, attempting to keep more or less intact the fundamentals of the original programs.

(3) The third method is to offer optional groups of study in special fields, eliminating part of the subjects formerly required of all students.

The second method is not satisfactory in general, as it often results in eliminating much of the desirable drill in fundamentals and in replacing it with informational courses, rules of thumb, and hand-book designing, routine drafting, and the mechanical performance of laboratory exercises.

The third way is probably the best that can be done if we must specialize in the time allotted to the undergraduate courses. By this plan students can acquire a fundamental knowledge of the mechanics, and a good beginning in one field of engineering without sacrificing vigorous mental training. But under such specialization the students are too often inadequately prepared to enter advantageously other fields than the one which they have chosen; and if they do not select the fields where the opportunities of their own future may lead them, they may be permanently handicapped by the narrowness of their training.

A study of the catalogues of engineering schools will convince anyone that some schools have met this matter of specialization squarely, that many have not, and that some programs are a compromise between an attempt to specialize and still to retain all the fundamental subjects. It is not uncommon that students carry ten, twelve or even more separate courses simultaneously through a term of fifteen weeks. These courses vary from a lecture of one hour per week in each subject to drafting or laboratory courses of six hours or more a week. Some of the courses neither require mental effort, nor produce any mental reaction, and in many instances the programs are so crowded that there is little opportunity for mental digestion. We are in theory at least training young men to solve engineering problems, and if they are not trained to think, the very end of education is defeated. Too often all but the most vigorous students take degrees and enter upon their professional work filled with undigested facts, but little competent to meet and solve real problems.

It seems pertinent to raise the question whether many existing programs in our engineering schools are not more or less haphazard development from courses originally designed to train students primarily for corporation service. What we need at the present time, as a prominent engineer recently said, is to educate engineers for public service as well as for corporation service. They should have the technical subjects, but they should also have training in business administration, financing, in organization, and the principles of accounting, and in matters which pertain to the commercial, industrial and civic institutions of the country. And above all they should be fitted to take up engineering problems, not only from a technical standpoint, but also with the broadest and soundest consideration of all the elements involved.

But it will be asked how can we do all that is now being required in the time available, and add more to it. Perhaps we cannot, but we can, I think, improve the training of our students without adding to their years of study or increasing the age of graduation. Under the existing conditions of entrance, and with the preparation which students ordinarily have upon entering college, the betterment of the technical course is to be found in the simplification of the programs, in the elimination of over-specialization, in a more thorough correlation of subjects, and in the reduction of the number of subjects attempted. And by specialization, I do not refer merely to new fields; I believe it is entirely possible to over-specialize, to the disadvantage of the students, in certain elementary subjects, such as drafting and surveying, and in the most advanced subjects, such as railroading and structures. It is quite possible to provide within the limit of the four-years' course, a well balanced program which will give civil engineering students about an equally good preparation in the fields of highway work, structural work, water power, railroad and sanitary engineering, and make every part of the program a vigorous course in mental training.

I think, however, that if we stop there we fall short of solving our problem. We are too much given to thinking in terms of the four years of the technical courses, forgetting the other twelve or more of earlier schooling, and the years of study which should follow in the career of every engineer. We teachers know that many, if not the majority of students enter the schools with careless and slovenly mental habits; many cannot write or speak correctly and clearly, and many cannot do arithmetic or elementary mathematics accurately. And, although considerable effort and much time is given during the four years to correcting early acquired habits, engineers and teachers know that many leave the schools with more or less the same unsatisfactory qualities that they had when they entered. Moreover, much time is spent in college in repeating subjects which the students have already studied long enough to master up to a certain point, but which they have not mastered, and too much time is given to studying subjects which can be as well or better studied

at an earlier age. Higher standards both for entrance to, and graduation from our technical schools should be more uniformly enforced.

It has been repeatedly asserted by competent educators that at least two years can be saved in the secondary schools, and that students can be graduated two years earlier from college if a better co-ordination of work between the secondary schools and the colleges could be secured; and this does not take into consideration the fact that a large amount of time is wasted for the older boys and college students in the long summer vacations. Two years added to the productive period of college graduates would be great economic saving, to say nothing of the possibilities it would offer for adding to the present course certain studies which are highly desirable and which in many instances could be added if it were not for this waste of time. It is certainly possible to fit all of our students to enter college at least one year earlier and to make available considerable time out of the four years for such studies as engineering students ought to take to fit them for the business and administrative duties which they may be called upon to perform.

A radical reform in the use of time during the years of schooling concerns not only highway education but all education, and will certainly come to pass under the stress of a growing economic necessity, but it seems to me that these reforms should be hastened by every influence that engineers and others interested in the welfare of young men can bring to bear. It is especially important in engineering because the majority of engineering students do not come from wealthy homes and the cost of instruction, as well as the cost of supporting them while they are not earning, is a very heavy tax not only upon their parents, but upon the community. Moreover, the years of apprenticeship of young engineers are long and their salaries are small. Students should enter upon their work not only as early as possible, but also as well equipped as may be, not only for highway engineering, but within reasonable limits for any engineering work that the chances of life may offer them.

THE CHAIRMAN: Next on the program is the Washington-Atlanta Highway, by Charles P. Light, Field Secretary of the American Highway Association, but Mr. Light's duties have been so numerous that he has asked Mr. George C. Scales, Highway Engineer of the U. S. Office of Public Roads, to take his place.

MR. SCALES: *Mr. Chairman and Gentlemen:* I know you missed a treat by not hearing Mr. Light, as I am a very poor substitute for him when it comes to speaking. I will try in as few words as possible to tell you what we are trying to do. For about 20 years the Office of Public Roads has been building object lesson roads all over the United States, collecting cost data and having bulletins printed to be used in different parts of the country, but no systematic attempt at maintenance has been made except in the case of a few

high priced roads. The American Highway Association made a proposition to the U. S. Office of Public Roads that if they could get about 1000 miles of roadway, they would try out the question of maintenance; the Office of Public Roads to detail three engineers for the work and the American Highway Association to furnish three automobiles for the use of the engineers. The road from Washington to Atlanta was selected. It is a road that comprises about 95 per cent of all the types of road in the United States. They wanted to get the coöperation of all the counties along the line of this road, because the United States was not going to spend any money whatever. They met with hearty coöperation and inaugurated the scheme, and in May appointed three engineers, Mr. Winslow for the northern division, myself for the southern and Mr. Spoon for the center. The idea was for the counties along this road to set aside a thousand dollars a year for maintenance to be spent under the supervision of the U. S. Government engineers. In Virginia at the present time they have about 200 miles of 275 under maintenance. The plan has just been started. In South Carolina and a part of North Carolina they have about 50 miles. On my section of 300 miles in Georgia I haven't any under maintenance yet, for the following reasons: the counties have spent about \$25,000 so far in widening the roads, putting in pipes where they formerly had wooden culverts, and putting on soil. In the next three or four months there is going to be a great deal more money spent and I did not want to put them under maintenance until they were in such shape that they could be maintained. The original idea was to have a single road from Augusta to Atlanta, but there was so much rivalry that they finally took both, so the line split at Thompson, Georgia, one part going by way of Washington, Lexington, Athens, Monroe, Stone Mountain, and the other by way of Warrenton, Coffinsville, and Latonia. The roads have been greatly improved and a great deal of interest shown by all these counties. In many cases roads only 15 feet wide have been widened to 30 feet, and I expect within the next six months those roads will be in such shape that most of them can be put under maintenance. The proposition is entirely a novel one and the work is being done entirely by counties; no money is being spent by the United States whatever, the government simply furnishing an engineer. In this way we hope to demonstrate that it is better to keep a road up than to let it go to pieces and try to re-build it at large expense. The problem of maintenance we are just beginning to realize is as important as that of construction, and that as soon as a road is finished, it ought to be put under maintenance. I thank you for your attention.

THE CHAIRMAN: That concludes the program for the afternoon. The meeting stands adjourned until 10 o'clock tomorrow morning.

GEORGIA DAY

November 13, 10 A.M.

MR. W. TOM WINN IN THE CHAIR

THE CHAIRMAN: Ladies and Gentlemen, the meeting will please come to order. We are going to shift our program just a little, because one or two of our speakers have been detained and will come in later. I wish to introduce to you for the first address of the morning, Prof. R. D. Kneale, Associate Professor of Civil Engineering, Georgia School of Technology, who will speak to us on "The Educational Campaign for Road Improvement."

THE EDUCATIONAL CAMPAIGN FOR GOOD ROADS

PROF. R. D. KNEALE

Associate Professor of Engineering, Georgia School of Technology

The writer has chosen this subject because he believes it involves questions infinitely more important than those of type of pavement, or choice of machinery, or of organization, finance, or construction. He believes it involves the question of whether a large majority of our people shall take an abiding and an intelligent interest in our streets and highways, or whether that majority shall remain in indifference and ignorance. Approach one hundred men at random on our streets today and the consensus of opinion obtained from them would point to looseness, or inefficiency, or graft in the handling of public funds for road purposes. Rural opinion would only emphasize this verdict, for the soap-box philosopher, who really crystallizes rural sentiment, is slow to appreciate, slow to praise. Sometimes the only cure for his mature prejudice is to sell him an automobile. It is a condition that exists because of ignorance and indifference, and it is unjust and wrong. It prevents financing. It prevents construction. It prevents progress. It should be rectified. The writer hopes to emphasize a basic means for accomplishing this end.

This meeting is primarily an educational one. We meet here to learn and to teach; to know and to be known; to give and to receive inspiration. This is a clearing house of matters pertaining to highways. Atlanta invites you here to learn of her greatness, and progress, and her hospitality. Upon adjournment the proceedings of this congress will doubtless be compiled and any one of us sufficiently interested may secure a copy. We are engaged in an educational campaign of mutual self-help. It is an educational meeting but we reach only those who are already interested in the good road movement. We relieve the above mentioned evil condition almost not at all. This is not a failure on our part. We are performing the

function for which we are organized. We are not attempting to reach many of the family of Mr. Common People.

Other road organizations are also filling their chosen field in this campaign of education. Chief among these is our Office of Public Roads, highly efficient, and certainly doing a splendid work. In the interest of national development and progress this organization should be allowed to rapidly broaden through Congressional appropriations commensurate with the paramount importance of good roads in national life. The large majority, however, of those reached by this office are already sufficiently interested to attend meetings, to inspect roads, or to at least send a stamp to Washington. The masses of our population are not interested, and their attention cannot well be forced by present methods. The States through their commissions are ably supplementing the work of the Office of Public Roads, and they are reaching about the same class of people. The press, in the advance ranks of civilizing influences, the National Highways Association, the American Automobile Association, and other organizations are doing a magnificent work, but they cannot cram the people with that for which there is no demand. They are meeting the growing demand for knowledge, and they are forcing that growth to some extent, but of necessity they fail to reach the large mass of indifferent and ignorant to whom I refer.

Road education is crammed into a few by those who desire to sell road machinery and materials, or by real estate development companies, technical colleges are reaching a few, but the mass not reached by any of the above agencies is large. It numbers a great majority of our hundred millions, and under the present method of attack the diminution of that majority, though increasing, is yet too slow for so great a cause. The reduction of that majority should be hastened by striking at its very roots through the public school system.

There are over twenty-five million children of school age in the United States, and some twenty million of these are in school an average of ninety days per school year. Thirty-four per cent of these children are above the fifth grade, and their minds are keenly susceptible to impressions that will last through life. The social, the financial, and the political phases of the road question can readily be made to touch their lives at many points with living interest. No pressure will be required to keep that interest alive, only a hand guided by a reasonable intelligence. If pressure is needed it will be to bring their attention back to the dry bones of the three R's. The children will take their new interests into the home to arouse a parent who can be reached in no other way. If the danger of loosely spending easy money lies in bond issues, the child can grasp the idea. If the advantage of a good road can be had only through paying for it on the bond issue instalment plan, he can also understand that. The consolidation of rural schools requires good roads and forces good roads, and the child easily sees the all round advan-

tage and becomes an ardent advocate. In fact the child can grasp to some extent each social, financial, and political phase of the road question, and the community interest in a common good will make him a better citizen. His grasp will develop and broaden with years until he takes over the reins of finance and government. Then there should be no lack of progress through ignorance, and the public will exercise so highly intelligent a supervision as to preclude the possibility of misuse of public money. What an opportunity to strike at the roots of ignorance at the rate of twenty million a year!

It may be urged that the average rural teacher is too immature, or that she lacks the training to handle so great a subject. She was not too immature to learn and to teach something of physiology and hygiene. She is not considered too poor an instrument to advance the cause of scientific agriculture. Surely a person can grasp something of the social advantages of good roads as readily as he can the physiological function of a human organ, or nitrification of legumes through bacterial inoculation. Besides, the ability of rural teachers will increase materially with the consolidation of schools.

To initiate this educational movement, requires no new organizations, and but little change in existing ones. The Office of Public Roads already has corps of expert lecturers and demonstrators, who are campaigning among the nation's adults. There they are forced to overcome the inertia of long fixed habits of thinking before they can plant seeds of interest and enthusiasm for good highways. They are also forced to overcome a certain prejudice against outside influence in local affairs. This same lecture corps could reach meetings of educators in institutes, and in city, State, and national teachers' organizations. Bulletins published by the Office of Public Roads could be re-edited to meet school requirements, and could be used as free text books for talks, round-table discussions, and inspection trips. Bulletins could be arranged also for the vocational courses in high schools.

We who are attending this congress want good roads. We have a certain appreciation of their value or we wouldn't be here. We desire to enhance the value of our city lot. We desire to reduce the loss between producer and consumer. We want jobs. We want to sell equipment. We want to develop our community, our city, our State. We want national development. First, last and always we are for road progress, yet progress is slow unless backed by an intelligent and an interested public opinion. There is no great difficulty in constructing a highway if the public is sufficiently interested to finance it. If the money is raised it will be expended by willing hands. If there is inefficiency in the use of the money, that evil will be reduced and eliminated with the increase of public intelligence and interest. We are now educating a number of adults, but the number is all too small for so great a cause, and we are almost

entirely ignoring the class easiest to reach, easiest to influence, and many millions strong. Their stronghold is in the public schools. Shall we storm that stronghold, or shall we continue to expend all our energy upon the mature prejudice of the adult? A panacea for many road ills lies with the public school.

THE CHAIRMAN: "Convict Labor as a Factor in Road Construction." Judge T. E. Patterson, of the Prison Commission of Georgia, will open the discussion on this subject.

MR. BLAIR: Just one word. I don't think that a paper of the kind we have just heard ought to be passed without a word of special recognition. What the Professor has said with reference to supplementing the work of education in this country along the lines of which he speaks—behind that he has, with hidden modesty, failed to say one word that ought to be said in favor of the technical and engineering schools of this country, which are doing the very work, so far as they can, that he speaks of. I think that acknowledgment ought to be made publicly, because the moral force that is being exerted by the technical schools in this country, cultivating the very sentiments, honesty and integrity among their students, ought to receive attention. They are doing a great work in this country and I am glad to give attestation to that fact.

PROFESSOR KNEALE: I neglected to say something of the work of that kind. I have been in it for some time. Up in Montana we carried on college extension work through the University of Montana, and I did considerable of that work and also the State Highway Commissioner, but we failed to reach public schools. I intended to mention the work the colleges and universities are doing in that line, but so far I believe the technical schools have failed to a large extent to reach the public schools, the high schools, the people who come together in road meetings.

THE CHAIRMAN: I am much obliged to Mr. Blair for impressing that thought upon us. We will now hear from Judge Patterson.

JUDGE PATTERSON: This subject was intended to be opened by a paper from General Clifford L. Anderson, on "Convict Labor as a Factor in Road Construction," and the discussion of that paper opened by Chairman R. E. Davidson, of the Prison Commission of Georgia. In the absence of General Anderson, who has been ill for some days, and of Mr. Davidson, I will endeavor to outline what Georgia is trying to do along this line. Georgia commenced this work 30 years ago to a limited extent; about 20 years ago, to a larger extent, and about six years ago, all the convicts were taken from the lessees who had been working them in lumber, turpentine and mining camps, brick making, etc., and all the able-bodied ones were put upon the public roads of Georgia. We have been engaged

all over the State since that time in constructing public roads by the use of convict labor. The material progress that Georgia has made within these past six years in the construction of public roads, is the highest testimonial that can be made for the system that is now employed. There are more than 120 counties in Georgia using their pro rata of the State convicts upon the public roads. There is hardly a county in Georgia that has not got a network of public roads that an automobile or even a Ford could be run upon at a rate of 20 to 30 miles per hour, without danger, and that progress has been made very largely in the last six years. Six years ago that condition did not obtain all over Georgia. There were certain counties in which the roads were fairly good, but in the large majority of the counties you could possibly travel over them to some extent in buggies and wagons, but it was hard to get automobiles over them. The first tours that were made, certain counties ahead of them had to do some patchwork on the roads so they could go over them. Now, you can go in any direction and find perfect highways all over the State, and that condition exists through the use of convicts. In discussing this convict question, you have to consider its effect on the convict as well as the value of his work to the community. Modern study in penalogy, or criminology, is based on the principle that confinement in chain gangs or penitentiaries is not altogether for the purpose of punishment, for the purpose of deterring others from committing crime, but to reform the criminal himself, if possible. Road work I think does that to a greater extent than any system of convict management known to man, and I think that it is based on the principle that when the convict is worked within an enclosure or under a lessee, he feels that no one is deriving any benefit from his work except private gain and that the only object in putting him in there is to punish him for his crime. You can go and preach to him and tell him he ought to be a better man and he will listen to you, but all the time he will have that feeling, "If you are interested in me, why don't you make some other provision for me? Why do you want to keep me here and crush me." The result is that all over the world there is what is known as a criminal class. They get into prison, they get out, and after they get out they commit some other crime and get back. It is the same old grind over and over, until we have built up what we refer to as the criminal class. We have the same condition in our cities; you can go to a police court in Atlanta or Macon, Savannah, Columbus, or any city in Georgia, or any city in the United States, and the police judge will tell you, as man after man will come up before him, or woman after woman, how many times many of those prisoners have been there before. He sends them to the stockade, they serve their time and are released, but it does no good; they go right back. It was formerly that way in the penitentiary system of Georgia. I daresay, under this system in the last six years, the men who have been convicted and sent to the penitentiary in Georgia and served

out their time—not 15 per cent of them have ever returned to the penitentiary. I think it is on account of three facts: one is that they see that the public is getting some benefit from their enforced labor; some individual is not getting it all, they see that when they get out, they themselves are going to get some benefit from it as a member of the community. They may not reason that out just like I am stating it, but it is instinctive in the human heart that whenever a man works he wants to have something coming to himself from the work he does; that is characteristic of humanity, and you appeal to that feeling in a man, and from that you build character. Another thing, they are worked in the open; the finest moral qualities instilled in anybody are from being worked in the open, in the sunshine and free air, and next to the soil. I think you will find that a large majority of the leaders of the world's thought, the leaders in commerce, in banking and in all branches of human endeavor—come from the farm. It is because the boys on the farm are raised in the open, next to the soil; they acquire from that condition surrounding them those moral qualities that make good citizens and make leaders in thought and in action. The same thing applies to a convict; he is worked out in the open air, he is worked in the sunshine; he gets that moral stamina in him that aids him when he gets out, to make a man. In some States, Colorado is one of them, they select certain convicts for road work. Some of the most desperate ones they don't work there. They keep them confined. In Georgia we keep all of them on the public roads on the theory that all men have the same intuitive instincts. If you can give him a basis on which to build, there is hope for any man, and if you give them all the same treatment, you have a chance to redeem them all. So much for the convict road work as a moral force. It is an economical force because the community is necessarily compelled to support these fellows anyway, wherever you put them. If you put them on your roads, the community gets a benefit that is commensurate with the outlay of money for their support. It is not necessary for me to describe the benefit of good roads to a community; your being here at this convention is a testimonial to the fact that you know that good roads build up a community and add to its prosperity, its social advantages, its uplift in every way. You understand those things better, probably, than I could tell you. Pardon me for referring to the Georgia laws in this connection. The one weakness of the Georgia system is the lack of in working their roads, the lack of coöperation. We have just begun by putting in a State highway engineer, Professor Stanley, of Athens. The law provides that we may employ four, and we intend to do so if the legislature will ever provide funds. That is what we are working for now. Our idea is, that if we have this corps of highway engineers to visit counties, and show the men in charge, the county commissioners and the wardens and superintendents in charge of the road working force, what can be done with the convicts they have

and with the material they have, we will be doing great things for them. I was very much impressed this morning by Mr. Adams' talk, the Commissioner from Polk County. We wrote to all the county commissioners of the State when we started to put in this system of supervisors and Mr. Adams was one of the number that did not think it would work, but this morning he got up and admitted that he had been visited by a professor of engineering from the State University for a short time and he didn't stay long enough. Just a short visit has converted him to the fact that engineers are almost indispensable. Then our idea is to divide the State into four districts, put an engineer in each district, and have an annual institute in each district, where all the wardens superintendents and road commissioners can get together and discuss with these four engineers, all the problems with which they have to deal. This, to my mind, would be a long step forward. There is a movement on foot to establish a system of State highways, not from Atlanta to Savannah, but to go into all Georgia and build public roads between the main towns, the county seats; these roads to be built and maintained by the State. The county could take care of the county roads, the laterals, and tributaries. We can do that without spending any more money than is being spent now; we can do it with the revenue the State already provides for this work. If the government ever furnishes any additional funds for building these roads, we can have a perfect system. It is right for the government to do it, they improve the rivers and what is a river except an artery of commerce? They improve the harbors at the mouths of the river. Why? To give greater facilities for commerce; if they can improve rivers to aid commerce, why can't they improve a public road to aid commerce? One is just as much an artery of commerce as the other; in fact the road is more an artery of commerce than the river; there's ten times the commerce goes over every road in Georgia as goes over any of these insignificant rivers that the government spends thousands and thousands of dollars upon. The government is bound to assist and with the assistance we get from the government and the taxes now distributed to the various counties from the automobiles, we will have the funds to maintain these gangs and Georgia will have the finest system of public roads in the United States. It is a great thing we are undertaking, but we are going to make plans to get the necessary legislation when our legislature meets next summer.

THE CHAIRMAN: Before calling upon Governor-elect Harris I should like to know whether anyone wants to discuss this very important subject, or ask Judge Patterson any questions. I am sure that his position on the Prison Commission and his contact with convict life in Georgia, well fit him to give any information or to answer any question that might be asked. Many of you have visited our convict camps, and have no doubt learned a great deal about our system.

A MEMBER: I think Mr. Patterson has so ably discussed the problem that there are no questions to be asked, sir.

THE CHAIRMAN: If there are no questions to be asked, I have the great honor and pleasure of presenting to you Judge Nat E. Harris, Governor-elect, to whom we have assigned no subject, but have given the entire right-of-way for just as long a time as he likes, because if you have ever heard him speak once, you will know that you don't have to put a limit on him and that you will stay until he gets through. Judge Harris.

JUDGE HARRIS: *Mr. Chairman, Gentlemen of the Good Roads Congress, Fellow Citizens:* That was a very nice introduction of the Chairman for which I thank him. It put a good deal of responsibility on me too. The truth is, I did not know I was expected to speak in this gathering until a day or so ago when I saw the program. I had written to my friends here that I could not promise to attempt to make an address, but stated that I would like to come up and look into your faces and hear somebody talk on a subject I knew was of great interest just now, so I might find out what it meant, what it was and how far it reached, what was involved in it and especially what you knew about it. This was the idea with which I came to this convention.

Now, I heard one of your speakers refer just now to Judge Patterson's familiarity with the convicts of the State. I used to be on the bench myself and sent a good many people to the chain gang who are working on the roads of Georgia today, making good roads for us. During the past summer, if you will permit me, when I was going over the State in the canvass for governor—by the way one of the hottest canvasses we ever had in Georgia, I reckon, for the thermometer rose to 116 in the automobile in which I traveled on one occasion, and the boys frequently asked me in the court house, with the thermometer at 106, if they might take off their coats when I began to speak; of course you know I told them to take off their coats and keep them off till the day of the election for me—I say, as I went along one day I passed a chain gang that was working on the public roads, when one man, wearing stripes, stepped out a little from the rest of the gang and said, "Judge Harris, I'm representing you here"! I found out on enquiry that he was a convict I had sentenced while on the bench, so I want this Road Congress to understand that I too have some right to talk on the subject of road building, that there are doubtless many able bodied workers in the chain gangs, sent thereby myself who are doing good work for Georgia, and laboring to make good roads for her people, for the farmers and merchants and the doctors and lawyers, that their business may be worth more in the State to them and to the people who depend upon them!

I came to this State about fifty years ago; I started out from a

little place up yonder in East Tennessee, called Jonesboro, the oldest town in the State. I traveled down along the slopes of the Blue Ridge and entered Georgia first in Rabun County, then came on through the mountain district, riding a kicking mule on the way, while my brother drove a wagon, with sure-footed mules too. Looking back over these fifty years, I remember how the trail from Tennessee ran then along the sides of the mountain, over the ridges and the valleys—nothing but a trail. The inhabitants said I'd reach the Old Federal Road after awhile. Well, I did and it was a road, no doubt, but it was a road you wanted to get out of as quick as you could. Wherever there was a fork in it and you took one fork and went a little distance you were sorry you had not taken the other. We often turned out into the fields to avoid the road, because one could get along there better than in the road. When I reached Georgia and looked back over the trail I had followed, I said to myself, "I will write a book and call it, 'Short Cuts on a Journey to Georgia,'" and that is what it was, for I was all the time trying to avoid the windings of the trail and get down here. That was fifty years ago; I went back over that country in the last three or four months—I came down over the same mountain cliffs and hills and valleys, but I saw they had laid out turnpikes where the old roads ran. I traveled in an automobile, moving from place to place with a rapidity that would have made our ancestors turn almost crazy and feel that some sort of magic had been at work in the world. It was easy traveling; the rocks had been blasted out of the roadway; the grades all laid out well, and I said to myself, "How has all this been brought about?" I see a man in the audience who could answer this question. He has furnished plan after plan and survey after survey to these counties through which I traveled, and their nice turnpikes and level roadways will stand the storm for many a day.

Some one writing on roads, said, "The degree of civilization in a country may be ascertained by finding out the state of its public roads." Is that so? If it is, I am ready to say to you here, in a representative capacity, in a private capacity, or in any other capacity, that Georgia is not afraid to show hands with most of you—that we have started in this State a pretty good system of roads and we hope to go forward until we even take the front. We have aroused competition among the counties.

Way back yonder in the past, you know, there were two ways followed in road working. The first was, where the county compelled by law, had four days' work done upon the roads each year—by summoning the citizens along the road to do the work, or in lieu thereof levied a small commutation tax, that was never collected or if collected, rarely applied: the second system existed where the county could keep a chain gang and supplemented the intermittent road hands with a force that worked all the year round. In the course of time the legislature gave us the three alternative road

laws, which was an advance on the former times. Now we have gone still higher in the scale, and the State and counties have all put their chain gangs to work exclusively on the public roads, and a system of improvement has been inaugurated that will really count in the future, and promises soon to justify our people in claiming that this great old State shall no longer stand behind her sisters when you come to estimate her civilization by the splendor of her public roads.

But there are two views taken of the progress in road building. A good old lady who lives down in the center of the State, whose memory goes back to the old system, said to a friend lately: "I don't believe in these new scrapers and automobiles for our public roads; all they need is the pine top and the hoe; that was what the people used in the old days. We land owners have to pay for these new things and in this way the folks that travel get the advantage of us." The old lady is not alone in her views; there are many who feel just as she does, so it will be necessary to educate the people till they realize the true value of the reform that is going on. There are not wanting those who will complain at the slightest increase of taxes, consequently it is the more important that the people generally should understand how the building of the roads, by adding values to real estate and its products, gives the owners in return, something with which to pay the increased taxes. And the whole county shares in the benefits. Why, a farmer now in the counties where the good roads policy is followed, enjoys all the advantages of country and city combined. His automobile carries him from the farm to the city and from the city to the farm with incredible ease, while his telephone brings him into direct communication with the great centers of trade as well as with his own neighbors and friends round about.

This competition among the counties, to which I referred just now, is destined to play an important part in our good roads movement. The smaller counties may well say to the counties with great cities, "You can put your money in fine public buildings and parks and streets, but we will put ours in our roadways, and make them better than your streets so that—bringing our produce to market easily—our farms shall increase in value as your own real estate ascends in the same scale." And this idea is getting more familiar every day. I used "to ride the circuit," as we lawyers call it—going around the counties adjacent to Bibb, where I live, to attend the courts and keep up with the business of my clients, traveling in a buggy or on horseback. In those days Bibb County, in which the city of Macon is located, worked her chain gang on the public roads. I could tell the exact point where I would cross the line into the other counties, for the Bibb roads were far better than those in the adjacent territory. Now, this is all changed. The small counties are beating Bibb, for they have chain gangs and improved road working too; you can tell now for instance, where you cross the line

into Twiggs, because Twiggs has better roads than Bibb. And the challenge is out to Bibb, "You may beat us in your buildings but we'll beat you in our roads." And so it is, through the State.

I am proud of the way in which we are going forward in Georgia, and I greet you all today in her name. I am glad to be a part of this Congress, to look in your faces and tell you that this old Empire State, is awakening on this great question, that her people will join you in the crusade, or better, the evangel in favor of good roads, and try to bring the whole country to understand and appreciate the importance of the subject.

And now, my friends, I want to say a few words, of a general nature, on the advantages of good roads to the community. These are so obvious, and this Congress has been urging them so often, that I suppose it is almost a work of supererogation to go over them again. But there are a good many Georgians in this audience, and I have thought it might not be out of place to repeat the argument in their presence. The truth is, the whole State needs good roads, and more roads, and better roads, everywhere. There is no end to such improvements. If the seaboard is to be brought to the mountains, or the mountains to the seaboard, this is the way to do it. There is that great country lying below us, known as the "Wire Grass,"—I love to talk of it now, because it was once under the ban—nothing but a vast pine barren. I have just had the opportunity of traveling over it, and can appreciate its coming strength and greatness. It is a region of magnificent possibilities.

Mr. Chairman and Gentlemen of the Congress, if you will only give that "Wire Grass" country good roads and reasonable railroad facilities, you will soon see an Empire developed in this Empire State, such as you never conceived or thought of, in all your life! All that is needed to insure the speedy settling up of those vast level areas of farming lands is to give the people good roads, so that more inhabitants may come in, take up the lands, utilize their unparalleled productiveness, and make the country worth all that it ought to be to Georgia.

It is rushing forward with wonderful strides every day, and this good roads gospel is taking it by storm, as it seems to be taking the State, the South, yea, even the whole Nation. But to restate the argument:

First: A good road enhances the value of the lands adjacent to it. This is an A B C doctrine. While the tax may be increased, the owner is afforded means the more easily to make the money, so that he does not feel the burden.

Second: The facility for travel and transportation enables the citizens along the road to live with greater ease and more comfort, to transact business with more convenience, and with the automobile, and telephone, makes space and time of far less consequence in the affairs of life.

Third: The good road tends to promote intelligence, for it en-

ables the children to reach the school house, with greater convenience, so as to secure the advantages of early training and education. Rough roads are sometimes a barrier to knowledge.

Fourth: The good road promotes both social and religious association. Visiting is made easier, and people of the community, or even of the State, are made better acquainted, and see more of each other.

My countrymen, I have noticed that the misunderstanding in communities, the troubles that spring up and beget endless sufferings among our people, would nearly all be prevented if the people only knew each other better. This is so, North, South, East and West—it is so, locally, it is so generally, it is so everywhere. If the people at large are given the facilities for travel and transportation they will come together oftener, learn to know each other better, and harmony will reign where discord now prevails.

Fifth: The good roads will tend to preserve the health of the community. You can provide the remedies for sickness with greater ease, in the country. I heard a gentleman say not long ago, that since they had opened the turnpike road by his house he could call a doctor from town and get him to the place in an emergency within 15 or 20 minutes, though he lived three or four miles away from the place.

Sixth and last: Good roads increase the population of the country. The more good roads we have the more people there will be to travel them. Oh! we have room enough here for any ordinary increase in our population. We do not object to the coming in of good settlers. We have lands enough in Georgia to house and feed our own people with their natural increase for one hundred and fifty years to come! So we can afford to divide with others, for none of us will live that long.

When people from a distance come to see us, find out what we have here, and learn that we have the best public roads in the country, see how easy it is to go from place to place—why, they'll know that we are up to date, and will fall in love with our good, old honest ways, and stay with us!

There is sometimes a humorous side to our road working. While I was on the bench a mandamus proceeding was brought before me, alleging that the commissioners of one of the counties of the circuit were not working one of the main thoroughfares running by the homes of the petitioners. It was alleged that they had worked all the roads of the county except the one in question; and this they had worked to within about three miles of the county line and then stopped. It seemed that just across the county line there was a thriving little town which was a rival of the county site, bidding very vigorously for the trade and business of the citizens round about. So the commissioners, standing up for their home town, let the road to the county line go without working till it became almost impassable, while the road to the county site was kept in splendid condition.

This was good political protection, you know, but the cold law would not stand for it. Competition in business and equality in transportation are the favorites of our statutes. Nevertheless, it was a practical demonstration of the fact that a good road counts for something in the community.

And now I think I have about covered what I wanted to say to this Congress. My recent travel over Georgia has at least given me some experience with the good road situation in the State. I recall the fact that several times when I hired an automobile at one county site to go to another, if the road in the first county was rough and difficult, and after crossing the line, got better, and smoother for travel, the automobile driver would apologize for his county, and say, "We can't get our commissioners to take the right view of matters, but we have hopes at the next election to show them a few things."

So, the demand for good roads is growing, for the people are finding out that a load of produce, of cotton, or corn, or any farm product, is nearly three times as large on a good, modern, well graded turnpike as it was on the rough highways of the past. And the county authorities are realizing that it will not do to be left behind in the progress of the times on this subject.

And now, my friends, I repeat that I am proud, as the next executive of this State, to come before this Congress and speak to you. If you need the countenance and help of the next administration, I assure you that you already have the chief, and I think you may count on the assistance of the legislature to do whatever is necessary to bring the subject before the people in the most effective light. Show us what is needed and we will try to put our shoulders to the wheel so as to push this old Empire State forward, until her name shall ring out among the people of the North and the East and the West, as the one State of the South that has the finest laid out public roads in the Union. It would be a distinguished honor to preside over a State that could safely point to her roadways, as the index of the highest civilization of the world!

THE CHAIRMAN: We appreciate very much the kindness of Governor Harris in coming to our meeting this morning and adding his presence to this occasion. The next speaker, as you will see on the program, gentlemen, is Prof. Charles M. Strahan, Dean of Engineering, University of Georgia, who will speak on the subject "Why Georgia Builds Top Soil and Sand-Clay Roads."

WHY GEORGIA BUILDS TOP SOIL AND SAND-CLAY ROADS

C. M. STRAHAN, D.Sc., M.A.S.C.E.

Dean of Engineering, University of Georgia

The counties of Georgia during the past six years have directed the bulk of their road building energy to the construction of soil roads of various kinds. They have recognized that any road worthy the name must have a reasonably strong, smooth, and durable wearing surface. They have secured satisfactory surfaces by the use of selected top soils, of semi-gravel, of sub-strata of sand-clay encountered in grading; and from artificial mixtures effected by claying deep sand road beds and by incorporating sand in sticky clay road beds. Some 12,000 miles of improved roads have been built and much of this mileage has been surfaced with one or more of the above materials.

There are four principal reasons why the energy of Georgia has gone into this type of construction: the first is an economic reason; the second is a psychologic reason; the third is a geologic reason; and the fourth is a scientific reason.

First: In round numbers, Georgia, with \$1,000,000,000 of tax values and 147 counties, is credited with 84,000 miles of road. Exclusive of the 7 chief city counties, the average county shows approximately \$6,000,000 of tax values and 600 miles of public highways.

These basic financial facts have compelled the counties of Georgia to carefully consider their financial policies. The outcome has been that while highly desirous of good roads, the justifiable basis of expenditures has been forced below \$1000 per mile. Hence they have turned to the local soils, intelligently selected and used, as the first step and only possible step toward extensive highway betterment within that average expenditure. They have recognized that the elements of cost for a road program are: (1) expert supervision, (2) preparation of the road material for use, (3) haulage cost, itself dependent on tonnage, average length of haul, and ease of loading and unloading, (4) cost of spreading, (5) cost of consolidation and shaping, and (6) the cost of maintenance. In all of these items, they have felt that the local soils with short hauls, needing no crushing or mixing, handled by simple tools and moderate cost machinery, easily loaded and distributed, consolidated by the road's own traffic, and all done chiefly by unskilled labor, presented the minimum outlay for equipment, labor, and all other construction costs. Nor have they been disappointed. Total costs as reported from various counties range from \$300 to \$600 per mile according to the particular material, the width of wheelway, and the length of average haul. They contrast the resulting roads with broken stone roads at from \$5000 to \$8000 per mile and figure that the interest on the latter investment would annually build a mile of good soil road. They

compare the maintenance figures of \$10 to \$50 per mile with the \$100 per mile credited to macadam roads and place at 15 years the life of each type. They find the traffic of all kinds pleased and contented, and see no undue injury wrought by the automobile. They feel that the betterment is real and durable, and that this type of road, free always from deep mud or deep sand, has at least met and conquered the two arch enemies of highway transportation.

Second: The psychologic reason is also a reason of practical politics. It consists in the fact that taxpayers, particularly the rural taxpayer, become rapidly restive unless the rate of road building and the consequent spread of the benefits of the road expenditure is reasonably rapid. The soil roads are built very quickly. Counties report from 20 to 60 miles annually. In five years, a great change is wrought in the traffic conditions of any county. The restive citizen may be gracefully bidden to wait; and his powers of revolution are inversely as the annual growth of improved mileage. There is thus a better chance for continuous county road management.

Third: The geologic reason rests upon the vast areas of underlying siliceous metamorphic rock in North Georgia, upon the gravel soils that abound along the edge of the Coastal Plain in Middle Georgia, and from the sand-clay strata which underlie so many of the counties of the Coastal Plain itself. Many of the resulting clay soils of North Georgia are abundantly charged with coarse sand and decomposed rock, and are of admirable road value. Intelligent search has revealed them in wide distribution and of exceptional wearing qualities. Gravelly soils and sand clay top soils are likewise found in many counties along the Fall Line that traverses the State from Columbus to Augusta. In the Coastal Plain counties, outcroppings of gravel are occasional, outcroppings of clay hills are quite frequent, and sub-strata of so-called clay, in reality a natural mixture of clay and sand, is widely found at short depths below the surface ready to be excavated and placed on the prevailing sand bed roads of that section. In some of the swamps of South Georgia the muck contains fine clay and is utilized as road covering.

The writer has been struck by the prevalence of suitable road soils in every county visited and is convinced that systematic surveys for the location of such soils adjacent to the highways would be amply justified in every county by the discoveries made.

This thought is commended strongly to the representatives of the Fourth American Road Congress. Few States in the Union can afford to ignore the substantial economies that accrue from the use of good local road soils, on at least a part of their highway systems.

Fourth: The scientific reason why Georgia is building top soil and sand-clay roads rests on the fact that by careful examination in field and laboratory, enough is now known of the composition, road behavior, and method of consolidating of these road soils to select them intelligently in advance of construction and to feel confident of the results. The School of Civil Engineering of the

University of Georgia, through its road laboratory and field officers, since 1908, has been privileged to work jointly with many county road officials in the study and use of these materials. It has been called upon to select and advise concerning suitable soils in advance of construction and has watched the roads after construction. Much data has been accumulated and digested, many partial and complete mechanical analyses have been made. The limits of this address does not permit detailed entry into laboratory methods, but the following short table of typical soils selected from roads of known efficiency in north, middle and south Georgia will serve to indicate the character of separations made:

TYPICAL GEORGIA ROAD SOILS

BY PROF. S. B. SLACK

Analysis After Separation From Gravel

		Gravel	SAND					Silt	Clay
		Above Diameters in Millimeters							
	North Georgia	1.85	1.85-.86	.86-.24	.24-.14	.14-.07	Total	.07-.01	.01-.00
476	4.0	8.0	33.0	17.6	13.6	71.2	15.0	14.0
466	13.0	19.6	44.6	8.0	6.0	78.2	4.5	15.0
150	3.0	8.5	36.0	12.5	11.3	68.3	12.2	11.0
10		7.8	34.3	9.2	9.0	60.3	12.8	25.0
	Middle Georgia								
108	0.8	0.8	30.1	15.4	20.0	66.3	14.1	18.0
124		8.0	22.0	14.7	15.3	56.6	14.6	27.5
424	10.4	2.8	81.3	18.4	25.0	54.5	12.4	31.0
120	10.4	4.6	22.0	14.7	15.3	56.6	14.6	27.5
106	10.0	4.	30.0	18.5	12.1	64.6	13.6	20.0
	South Georgia								
434		2.4	9.2	19.7	27.0	58.3	12.8	25.0
103		2.7	20.7	21.2	26.4	71.0	14.8	14.3
113		2.0	32.0	20.8	17.4	72.2	13.4	14.0
	Special								
470	Augusta Gravel.	15.2	28.0	54.4	6.0	2.2	90.6	3.4	6.7
116	Pipe Clay.....		14.3	16.9	4.8	4.7	40.7	8.8	50.0
	Sieve Numbers.....	10	20	60	100	200			

Unable to present in this article the specific road histories of these and many other samples studied, the conclusions tentatively reached by the laboratory may, however, be stated as follows:

First. The presence of from 60 to 80 per cent of total sand is necessary. The best soils show 45 to 55 per cent sand coarser than No. 60 sieve. The sand between No. 100 and No. 200 has little hardening value. See samples 150, 106, 10, 466, 476.

Second. Ten to 15 per cent of gravel above No. 10 sieve and smaller than 3 in. diameter is very effective in hardening. See samples 150, 10, 106, 466, 120.

Third. When the sand above No. 60 is less than 40 per cent the resulting surface is notably softer than with coarser sand.

Fourth. True clay in excess of 30 per cent gives a soft road with mud.

Fifth. The best clay percentages lie between 10 and 20 per cent.

Sixth. A highly colloidal clay in low percentages probably gives equal bond with a less colloidal clay in larger percentages.

Seventh. The non-plastic silt aids in reducing expansion of the true clay.

Eighth. Soils with all fine sand need higher percents of clay; but are not so hard in dry weather and wash readily in heavy rains. They require frequent resurfacing with road drags.

Ninth. All of the typical road soils in the table have shown ample betterment over the roads they replaced to justify the expense of construction.

The laboratory has reached a conception of the way these soil mixtures act which may be of service to those interested.

While the resulting surfaces are of varying efficiency, the better grades, usually carrying coarse sand and gravel, give surfaces too hard to cut with the heaviest road machines, capable of supporting the heaviest loads after long rains, free from mud or excessive dust, and uninjured by automobile traffic in both wet and dry weather. The medium grades carrying medium sand and no gravel are firm and hard but can be cut by heavy road machines; they are somewhat softened in long rainy spells but do not cut deeply, and are somewhat more dusty in dry weather.

The soft grades carrying chiefly fine sand are firm and strong in dry weather, are subject to washing in heavy rains, and softening, and can be resurfaced with light metal or split log drags. They usually show a lack of proper balance between sand and clay and mark the lower limit of suitable road soils.

The successful soil must carry enough hard aggregate to interlock and support the traffic loads and to resist grinding and crushing action. This property is imparted chiefly by the sand and gravel content. The variations of these ingredients in amount and size affects most strongly the hardness and durability of the surface. It is known that sand beds when moist are relatively firm unless the sand is excessively fine, and supersaturated with water. Quick-sand conditions are then developed. It is therefore probable that in wet weather the strength of the road depends primarily on the sand content, and that graded mixtures from coarse to fine are better than uniform grain or small sizes.

Through a nest of standard sieves No. 20, 60, 100 and 200, the sand is separated into four grades of fineness, and so reported in the analyses. The sizes above No. 100 are the effective body material. That below No. 100 has some value in reducing the total voids in the graded mixture.

Naturally the laboratory analyses pay particular attention to the quality, sizes, and total amount of the sand in the mixture. In the tables of analyses submitted herewith it is to be noted how large a percentage of total sand and of coarse sizes is found in the more successful soils. Moreover the item called "silt" is in reality mostly extremely fine sand.

The second important characteristic of a suitable road soil must be that it shall prove water resistant in wet weather and firmly bound and smooth in dry weather. Dependence for these properties is upon the clay elements and the silt.

The laboratory in its complete analyses separates and examines the quality of the true clay. It is to be noted how small an amount of true clay is found in the best grades—12 to 20 per cent. The contrast of clay contents in poor soils is shown in the sample of pipe clay included in the table with 50 per cent true clay. A further contrast in the other direction is seen in the analyses of the Augusta gravel with only 6.7 per cent of true clay. The bond of this gravel arises chiefly from its interlocking strength.

The laboratory defines "true" clay as that portion of the sample which remain in suspension after settling for 13 minutes through water 8 centimeters deep. It is removed by repeated washings, settling, and careful siphoning off. Most natural clays are impure and contain large percentages of coarser materials such as sand, mica, and silt. They vary greatly in plasticity and in the expansion and shrinkage under the action of water. The true clay contains an extremely fine portion called colloidal clay. The colloidal clay is very glutinous or gummy. The coarser clay has less gumminess. It is thought that the binding value of the clay depends to a notable extent on the amount of fine colloidal ingredients. In dry weather, this gives great adherence, but unfortunately in wet weather the colloidal matter softens quickly. It probably is one of the chief causes of the high expansion of the clay when wet. The argument would then be that a clay too rich in colloidal matter when used in a sand clay mixture is apt to soften too readily and by swelling tends to break the interlocking strength of the sand grain. The larger the total clay the greater the expansion. The desirable kind of clay would be that which has a rather low colloidal percentage to meet wet conditions but yet enough to bind firmly the sand grains in dry weather. It also appears desirable that the total real clay should be as low as possible consistent with adhesive strength in dry weather to avoid expansion effects. This also points to the value of a closely graded sand mixture with a minimum of voids and thus requiring a minimum of clay.

It is evident that the small percentages of clay in the best road soils is not enough to fill the usual 30 to 35 per cent voids that exist even in a well graded sand. But the silt material together with the true clay do furnish enough to fill these voids. The silt as separated in the laboratory analysis is itself largely composed of silica or sand which passes a No. 200 standard sieve, and other equally fine material of partly reduced soil minerals such as feldspar, mica, etc. It shows little plasticity or adhesive value unless iron salts are present, but is useful in filling voids. It may be said that the true clay, the silt, and, when needed, some of the fine sand

(between No. 100 and No. 200 sieves) really compose the "binder" which unites the coarser sand particles, and fills the voids. For ordinary cases of soil examination the separation of the binder from the coarser sand by washing and rapid decantation is sufficient to give a fair basis of judgment regarding its suitability for road building. The more complete analyses aid in forming a sound conception of just what goes on in the consolidation and road behavior of the material.

In all of these materials efficiency requires a uniform and intimate mixture of the sand and the binder.

The consolidation is effected by the construction teams and the regular traffic. A bed of the loose material 10 inches thick and 16 to 20 feet wide is deposited in one layer. The traffic gradually packs it. A period of wet weather is desirable for a green road as the wheels and hoofs then puddle and pack the mass from the bottom upward, aiding also the uniform mixing. During the consolidation process the surface is kept in shape by the frequent use of the road machine until the final surface with a crown of one-half inch per foot is firm and smooth. The semi-gravels are top soils carrying 10 to 15 per cent of hard quartz gravel. All material coarser than a No. 10 sieve is classed as gravel. Rocks above 3 inches in diameter are objectionable and should be removed while loading, or dressed to the bottom of the 10-inch soil layer as the work goes on. The gravel if hard and non-crushing is a distinct advantage to the road soil playing the part of the broken stone in a cement concrete mixture and giving it greater hardness and stronger supporting power in wet weather. But soft gravel of feldspar hardpan, or mica schist is undesirable. In some counties an iron-silica gravel mixed with the soil is found which gives admirable roads.

The packed top soil surface from the best soils is surprisingly hard and surprisingly water resistant. It requires a rock plow or a heavy macadam type of scraper drawn by a traction engine to break up the bed when once thoroughly packed. The laboratory has taken up solid blocks, 20 x 20 inches and 6 inches thick, after weeks of rainy weather, from these roads.

Although very dense, the blocks taken from the road are distinctly porous in character. Why then does not the rain saturate the bed and loosen the bond between the sand and clay? The following explanation is suggested: The rain soaks into the pores of the dry road, at first carrying fine particles of dust to seal up the capillary tubes and pores. The first moisture absorbed by the clay expands it and also tends to close the capillary tube and pores. Hence the further ingress of water is prevented, the main slab is not softened, and the only mud is a thin coat on top where the wheels have loosened the surface by grinding and slight cutting. When rain ceases the skim coat of softened material will pack and rebind with the slab below. Excess of clay in the mixture by swelling with water loosens the interlocking of the sand structure,

is too soft to withstand the cutting by the traffic, and permits water to work and puddle downward layer by layer until deep mud results. Excess sand works inversely. Not being sufficiently cemented in dry weather, the clay binder is broken, pulverized, and blown or washed away leaving a loose sand layer which finally becomes objectionable. The well-balanced sand and clay mixture avoids both of these weaknesses. The surface mud is thin and remains underlaid by firm material. Hence the traffic is supported. It does not stick to the wheels. Hence unlike the usual earth road, the top soil roads are not easily cut into deep holes by the constant churning and withdrawal of material by the wheels. Dry weather in fact is more like to break them down than rain—particularly if the sand clay ingredients are not uniformly mixed. A good crown is necessary to prevent long saturation by standing water.

It is a serious structural mistake to use too thin a layer of these surfacings. A depth of 6 inches loose packing to 4 inches on sand and loam road beds and 10 inches loose packing to 6 inches on clay road beds is essential. On fresh embankments and on rotten mica foundation a thickness of 12 to 14 inches loose will give adequate beam strength to offset the weakness of the water-soaked foundation.

The chief hurtful impurities encountered in road soils are mica and feldspar. Their presence is readily detected by examination of the separated sand contents. The feldspar either as gravel or sand is friable, easily crushed, and weathers rapidly into clay. Any large amount is distinctly destructive of good service by the soil. Mica in abundance is similarly undesirable above 2 or 3 per cent. The flat scales destroy the interlocking value of the sand and furnish slippery surfaces along which water penetrates and rapid softening ensues.

The influence of organic matter is distinctly helpful in binding these soils, but is rapidly lost by decay and weather action.

The writer believes that the possibilities of road surfaces made from natural soils are far greater than is now realized.

More careful attention to the exact mixtures, intimate stirring and mixing, the use of sprinklers to secure proper moisture, and finally the positive consolidation of a definite thickness by the use of tamping rollers, while possibly nearing the cost to \$1200 per mile, could result in surfaces permanently serviceable to the heaviest rural traffic.

Moreover, where the expenditures for rock covered roads are now nearing from \$5000 to \$10,000 per mile, the \$1200 soil road would leave ample funds for constant road policing and immediate repair, thus solving that really unsolved yet vital road problem, to wit, proper maintenance.

THE CHAIRMAN: Is there anyone who wishes to discuss briefly any of the points in Professor Strahan's paper? If not, we are going to adjourn the meeting. Governor Harris is anxious to go

through the exhibits and no doubt there are quite a few of our Georgia commissioners present this morning, who just arrived in the city last night and this morning and are also anxious to visit the exhibits. We will adjourn the meeting until 2 o'clock this afternoon.

Friday Afternoon, November 12, 2 P.M.

W. TOM WINN, PRESIDING

The principal address at this session was an illustrated lecture by Dr. S. W. McCallie, State Geologist of Georgia, on the "Road Material of Georgia." In order to secure proper equipment, this lecture was delivered in the moving picture room.

At the conclusion of Dr. McCallie's lecture, President Fletcher, in a few well chosen remarks, expressed his great pleasure at the unqualified success of the Congress, and thanked the officers for the valuable assistance which they had given him.

No further business appearing, President Fletcher declared the Congress adjourned sine die.

WOMEN'S CONFERENCE ON ROADS

Ansley Hotel, November 10, 10 A.M.

Under auspices of the Woman's Department of the American Highway Association.

Mrs. Robert Baker in the Chair.

THE CHAIRMAN: The Conference will please come to order. It is very fitting that this new movement among women should be launched in the State which first offered to American women the equipment by which to make herself useful in civic life. Georgia's example has been followed until now there is a great army of highly educated and intelligent women eager to help their brothers make this country a model for all the world. No activity in which they can engage will have a more beneficent and far reaching effect than this, to remove the check upon our social development and our material prosperity caused by our disgraceful roads.

Great oaks from little acorns grow! It is with the hope, with the *assurance*, of great things to come, that I greet you here today and introduce to you as the first speaker at the first women's conference on roads, the wife of your governor, Mrs. John M. Slaton.

MRS. SLATON: *Ladies of the Good Roads Congress:* I am glad to welcome you to a State that has exalted woman by establishing the first female college in the world—in Macon, Georgia. The devotion of our splendid men speedily expressed itself by affording a widened horizon through the instrumentality of education, and with this greater power is imposed the greater responsibility of service.

Our sex is being called upon to a greater extent than ever before to aid in the practical activities of life, and especially in those which affect the home. Feminine sympathy is ever alert when the happiness of the fireside and the interest of childhood are involved. A large proportion of our citizens live in the country, and accessibility to church and school house, the receipt of daily mail, the extension of the limits in which local papers can be circulated on the day of publication, the use of parcels post, are dependent upon our highways and necessarily affect the happiness and welfare of our sex.

Good roads mean more land cultivated, and more profitable crops, and a decrease in the cost of hauling them to market.

The purpose of the Woman's Department of the American Highway Association is to create through the educational work of women, a demand for an efficient State Highway Department, and also for the constant and adequate maintenance of roads built with the public money.

A wise administration lowers the cost of materials since they are bought in the largest quantities. It prevents the unnecessary

duplication of road machinery—it reduces the number of road officials. For instance, under the administration which generally prevails in the United States and which is based on the theory of extreme localization of authority in road management, there are nearly 140,000 road officials. The road laws in most places do not require of these men any technical knowledge of road construction or repair. Reforms which would substitute a comparatively small body of trained men, giving all their time to road work, would save the country more than \$50,000,000 every year.

A joint committee, composed of a special committee of the American Bar Association, a committee of the American Highway Association and a group of the foremost road engineers of the country are engaged in the compilation of a code of laws for the State administration of highways. When that code is published the Woman's Department will work in each State for such parts of the code as are applicable to climatic and other local conditions.

This code of laws will provide for a State engineer, his assistant engineers in charge of sections of the State, then county assistants in charge of the road supervisors, etc., section bosses and the necessary laborers. These men, from the highest to the lowest, should be appointed solely for their competency, and should be retained in office as long as their work is what it should be.

Good roads mean an increase in our rural population, and a consequent decrease in the crowding of our cities, and thus a lowering of the cost of living. More prompt and less expensive medical attention—far larger school and church attendance and above all new life for the farmers' wives and daughters.

Personally, and for the women of Georgia, I welcome you—our homes are open to you, and I trust that you will take with you on your return the memory of a sympathetic and kindly people who have been glad to have you as their guests.

THE CHAIRMAN: As at the Road Congress the men are welcomed by the Governor of the State and the Mayor of the city so are we welcomed by the women who represent the State and the city. Our second speaker is the President of the Atlanta Federation of Women's Clubs. She is the leader of 8000 energetic, altruistic women, all busy about many good things. I have the honor to introduce Mrs. Samuel Lumpkin.

WHAT ORGANIZATION MEANS TO WOMEN

MRS. LUMPKIN

President Atlanta City Federation of Women's Clubs

I am quite sure each and every one of us here understand the importance of federation and coöperation, the importance of co-operative effort and unity, not only among ourselves, but with men, in every undertaking that is worth while. We all understand that we

must work in unity and that no one individual can accomplish anything no matter how great their ability or efforts, unless they co-operate with others and make the effort worth while. I think we all understand that, and we all know that organization is the greatest thing of the present age for accomplishing things and I think in this civic evolution in which women are becoming more and more interested, it is not because of their wish to rule or show their authority over men, but simply because it is their aim and wish to be of *help*. And I think this meeting and all other meetings of women are simply for the purpose of coöperating with the men by forming organizations among themselves to aid the very best and to be of the most service and the most help to the men—we want to do things to help other persons, and I believe we are coming more and more into public life ourselves, because the world is so now that we must do it.

This Road Congress, I think, is a magnificent thing, especially for the country woman. We cannot say too much for the country woman. I know what she has to contend with and to suffer. For years, my husband was a circuit judge over a large number of small villages, and I myself have gone over all those country roads, and I know what it is to be in the country. Many times we had to go through creeks, without bridges, when I would have to draw my feet up on top of the seat. I *know* the hardships the country woman has to undergo.

We cannot say too much for the country woman—she has the dignity and sweetness and unselfishness, which is the most appealing thing in the world. We cannot say too much for good roads. We must all bow down in reverence to the country woman—therefore, everything that pertains to her comfort and health, we want to have a hand in accomplishing.

THE CHAIRMAN: Mrs. Logan Pitts of Calhoun, Georgia, Chairman of the Committee on Civics, Georgia Federation of Women's Clubs, will now tell us what the club women have already tried to do for the Georgia roads. Mrs. Pitts.

WHAT WOMEN ARE DOING FOR ROADS NOW

MRS. LOGAN PITTS

Chairman on Civics, Georgia Federation of Women's Clubs

"Good Roads"—this subject of good roads which we are here to discuss today, is one that is dear to my heart. Since this movement was endorsed by the General Federation of Women's Clubs about three years ago, the study of this subject is being engaged in by club women throughout the country. As Chairman of Civics for the Georgia Federated Clubs, it has been my policy to urge the importance of this need as being essential to the development of the best intelligence, happiness and prosperity of our people and the clubs through their civic committees and their county papers have done much in the promulgation of this principle of good roads.

The activity of the club women, the constant agitation of the subject by chambers of commerce, and other agencies, through the columns of leading magazines and the daily press have resulted in the creation of a public sentiment, favorable to the good roads movement.

When Mr. Roosevelt asked the people of rural America what would contribute most to their happiness, nine-tenths of their answers were, "Good Roads." Mr. Page says: A mighty wave of sentiment for good roads is sweeping over the entire country, and already the American people have entered upon a road building era which has no parallel in the history, not even the splendid era when Rome knit together with massive military roads the far fleeing outposts of her empire, nor the century of constructive work begun by Napoleon, which has given to France most superb systems of highways in the world.

Nearly all the States have established departments of highways and have provided for State participation in the building and care of the highways.

The rapid introduction of the automobile into every section of the country has revolutionized traffic conditions—it has brought people close together, the concentration of population in manufacturing and traffic centers has made necessary the transportation of immense quantities of food from the producer to the consumer and the transportation of immense quantities of manufactured products back to the farm dwellers from the city factories. The vacation-loving American has made possible the opening up of summer and winter resorts and has made accessible the splendid scenery of our country.

The cumulative results of all these individual forces has been the weaving of a web of interdependence which reaches every city, every town and every farm house. The public highway is no longer a mere local utility, it is a national asset, a national responsibility, and the Congress of the United States has come to a realization of this fact to such an extent that the day of Federal aid to road construction is at hand.

The need for good roads is apparent—the demand for them is becoming universal, the question now is, how are we to secure them and maintain them so as to give the most efficient service to all the people at the least possible cost.

This subject is being studied from a scientific and business-like standpoint for the first time in the history of the country. Let us hope that the deliberations of this Good Roads Congress may result in some plan for highway improvement that will meet with the approval not only of the State and Federal road officials, but also the people at large. The interest of our Georgia club women in this subject as I have said before, has been expressed, so far, mainly in the agitation of the subject with a view to arousing a public sentiment favorable to this movement, while our efforts have been directed principally to the elementary principles of civic

betterment. That clubs have outlived their period of amateur effort and are already taking a broader perspective of the work, was shown by their ready response when just one year ago it was announced that the department of civics had enlisted the interest of railroad officials in a coöperative scheme of promoting a State-wide improvement of station grounds and rights-of-way. Immediately, numbers of them took the matter up with their railroad officials, and already much has been done.

We believe the work accomplished at those places to be a forerunner of those larger achievements of civic betterment, which we await with faith and strivings, and which will include not only a State-wide improvement of station grounds, but also, a system of good roads, generous enough in its layout to provide for a scheme of beautification similar to that of the proposed Lincoln Highway, which is to be built from New York across the continent to San Francisco. Interest in this highway is general and has given impetus to the good roads movement throughout the country. Affiliations with the Lincoln Highway Commission is a Lincoln Way Tree Committee, composed largely of club women, which is working out a plan for its beautification and it has been proposed that each State adopt a distinct style of its own by planting trees, shrubs, and flowers that are indigenous to the State through which it passes. For instance—New Jersey will plant fruit trees for their bloom in the spring and their fruitage for travelers in the fall. Michigan women will plant a car load of walnuts. The women of Utah have a wonderfully interesting idea—the pines of their mountains, the tiger lily, their State flower, the roots of which provided nourishing and delicious food for their pioneers when all other food failed them, the cactus and the sage brush of their deserts and emblematic figures of salt where no vegetation will grow.

In California, the pepper tree will be used, and the children of Oakland have been gathering golden poppy seeds, and will sow them after the fall rains with the blue lupin to border them, so that motorists may drive through many miles of blue and gold bordered highways, when they attend the fair in San Francisco.

What a beautiful idea it would be for the children of all the States to assist in beautifying the highways.

Italy has her Appian way, England her magnificent roads with their famous hawthorn hedges, France her superb system of highways, the finest in the world, bordered with shoulders of green. America will have her Lincoln way—Georgia must join hands with her sister States in making this road as splendid, as extensive, and as beautiful as any of those which the old world boasts.

THE CHAIRMAN: The determining cause of this women's meeting has just appeared in our midst in the person of Mr. Page. I am sure you will wish to hear him speak although unfortunately the exigencies of a very full program will not permit more than

three minutes even to *the* road man of the country. It gives me great pleasure to introduce Mr. Logan Waller Page, Director of the United States Office of Public Roads and President of the American Highway Association.

MR. PAGE: *Chairman and Ladies:* Mrs. Baker told me she would allow me three minutes to talk to you and I am going to try and make my remarks as brief and practical as possible. I have watched the work that women have done in bettering our rural educational conditions and as President of the American Highway Association, last spring, I asked our Board of Directors to allow me to start a Woman's Department of that Association, for I believe that women could accomplish more in better county road management than men could. For 20-odd years, I have gotten up county and district organizations for the betterment of road management, but they never met with success. A man will get up in his county and say, "everything is all wrong here, we are not spending our money properly, we are not getting any results," but the men will wink at each other and say, "he is going to run for the legislature next year." Now, that's not the case with women.

To try and bring this fact home to you, I will give you an illustration. For the past six years, I have offered each county in the United States a first-class highway engineer, free of charge, if they would let that engineer direct the expenditures of the road fund in that county and to superintend such work and do as he thought best, etc. I have never succeeded in getting but two counties to accept that offer. Now the principal reason is that our road work, our county road work, is superintended by the vast army of some 140,000 road officials, which this lady has just told you about. That system was started in England during the reign of Queen Elizabeth. Oliver Cromwell did away with it in England, but we have stuck to it here. Now as a rule those road supervisors are selected, not because they have any knowledge of road construction but for political reasons—their compensation is too small and their term of office is too short to make it worth their while to qualify themselves, so the result is they are part of a great political machine, that's all. You will find a little account keeping of money on roads will show that work in this direction is not usually done on the most important road, but on the road on which the most important man in the county lives. I succeeded in getting a very rural county in Vermont, three years ago, to accept the services of a highway engineer. We agreed at that time that our engineer should report for duty and remain there a year from the first of May. He reported there on the first day of May and wired me that 80 per cent of the year's appropriation had already been spent. I wired him in return to remain and to go to their commissioner, ask him how much money he had received for road work and to show what work he had done. I told him to make an estimate of what he thought of the work and what it was

worth. He found that \$800 or \$1000 had been paid to one man, where the work could have been done for \$50 or \$60. We then held a mass meeting in the county. The people got our engineer to agree to stay there and take the remaining 20 per cent of the fund and see what could be done with it, with the result that never in the history of the country had so much good work been accomplished and the roads were never in as good condition. They finally asked me to let the engineer stay another year and they would let him direct and superintend the expenditures on road work. I let him remain another year. That county is one of the best good road counties in the United States today.

The work that can be done by women in our road work should begin in the counties. Now, very few of us are really familiar with real country conditions. I have called on Mrs. Baker to organize this work, to spread it out into the country and get the real country women to coöperate. We have got to help raise the country out of the rut. I am going to count on the women in this first meeting, where this subject has first been discussed, and I believe the women will accomplish the result we want.

THE CHAIRMAN: The Governor of Missouri has sent as a delegate a woman who has done practical work on roads. She has "bossed road gangs" and superintended the work on the roads near her farm. Though affiliated with many useful movements in her State, she tells me she cares most for her title of President of the Women Farmers' Club. I know we will enjoy hearing a little account of her activities as a "highway man" and a woman farmer. With these titles I have the honor to present Miss Frances Pearl Mitchell, of Rocheport, Missouri.

PRACTICAL ROAD WORK BY WOMEN

MISS FRANCES PEARL MITCHELL

President of the Women Farmers Club, Rocheport, Missouri

You have listened this morning to the aesthetic side of "Good Roads"—the humane side has also been presented. Now I am to tell you something of the practical work done by the women of Missouri.

As far back as 1909 the D. A. R.'s began working for the selection of historic roads as State and national highways. The result was the passage of an "Old Trails Road Bill" in Congress and the organization of a "National Old Trails Road Association" to which were eligible any one interested in historic roads. The Missouri branch of the National Old Trails Road has secured the dedication of a State highway across the Missouri running from Kansas City to New Franklin over the Old Santa Fe Trail—one of the early commercial trails to the unknown West. From New Franklin to St. Charles, the highway follows the Boone's Lick Road—a path made by the pioneer Daniel Boone and his sons when they made their

annual trip to a famous salt spring near the starting point of New Santa Fe Trail. All along this highway of over 300 miles, historic points have been marked by red granite monuments, and in old taverns repairs have been made and relics collected.

The Missouri Women Farmers' Club, composed of women who personally superintend and manage their own farms, realizes the importance of good roads, as a means of reaching the markets, and of keeping in touch with community interests. They are earnest advocates of road improvement and have given much assistance to the work. Some have been interested in the "Good Road's for Child Welfare" association and have organized bands of "Boy Road Scouts" who drag the roads, cut weeds, etc., thus inculcating the interest in good roads in the embryo man. One woman farmer, after failing to interest her men neighbors in the split log drag, gave herself a practical illustration of its use on the roads about her land, which resulted in the community following her example.

When the Governor of Missouri issued a call for two days' road volunteer work, and in overalls and straw hat managed a road grader himself, these women farmers sent their teams and men, furnished lunches for the workers and in every way assisted in the movement. The president of the Women Farmers' Club, a "bachelor maid" found herself one of the official superintendents. The "Bachelor Club" of the town, volunteered to work under her instruction, and a dozen weary, sadder, but wiser, men, before the day ended, realized what it was to be "bossed" by a woman!

A country school teacher in one of the remote counties has proved what can be done with the primitive one-room school house by converting it into a furnace heated, well-lighted building, with a basement equipped with appliances for teaching domestic science. The yard is an agricultural and horticultural experiment field and the boys and girls are organized into squads of road Scouts. She interested her patrons in road work and she and the farm women served dinners at the school house, which has become the community center—so much road improvement has been made that a community wagon gathers the pupils from the farms and conveys them to and from school.

There should be good roads committees in all our Women's Clubs which have any touch with social, civic, industrial or domestic conditions, for whatever women undertake with earnestness or zeal is usually achieved.

Bad roads are a travesty on good government. All nations as they advanced in civilization became road builders. Many of the fine highways of Europe are yet monuments of the greatness of the French Empire under Napoleon's reign. In the Holy Land the tourist and the pilgrim ride their jaded beasts over the broken stony road which the conquering Romans built for their war chariots, over two thousand years ago.

Our own nation has been too busy making history and amassing

fortunes, to build roads, but there is a wonderful wave of road interest enveloping the United States now. The horseless carriage has had much to do with it, for the city and town have common cause, when on pleasure bent. The high cost of living has been another awakener, both consumer and producer realizing that good roads must reduce the cost of food when transportation to market is made easier.

Women can do much by their enthusiasm toward getting the right kind of road legislations and by their demand for the wise and honest expenditure of road funds in their respective States and counties.

Good roads means the uniting of North and South, the East and West into combined effort toward progress and advancement of the Nation!

THE CHAIRMAN: Our next speaker is from Knoxville, Tennessee. She is Chairman of the Conservation Commission and personal representative of the President of the Tennessee Federation of Women's Clubs. I have long anticipated the pleasure of hearing her speak. With great pleasure I introduce Mrs. M. B. Arnstein.

CONSERVATION AND THE ROAD

MRS. M. B. ARNSTEIN OF KNOXVILLE

Chairman of Conservation Tennessee Federation of Women's Clubs

The greatest fact which strikes us when we compare the present day, with the years that have preceded it, is the enormous growth of human power. In this present age, we grapple with everything that pertains to the material prosperity of our country. We know that in facing the various problems of life, that we must consider the forces of nature in all her aspect, moral, economic and social, and in order to cope with this organization of life, we must conserve these forces.

Conservation is the powerful factor in human exploitation. The conservation of our forests, our soil, our water, our minerals, are all of inestimable value. They mean the wealth of the nation, the prosperity of the people, the heritage of the State. With all this wealth at our door; nature's resources o'erflowing in our lap, as it were, the great question is, how to make them available to the world at large?

We must conserve them, but we should do more. We should find a practical outlet for them. How? This problem is best solved by a system of highways and good roads. We may weave garlands of sentiment in our work but in the building of good roads, we are undertaking the practical, which interests and benefits the people socially, educationally, economically.

People everywhere are waking up to the fact that good roads are the prime factor in commercial, social, economical and industrial conditions. The nation is alive to the question and rural life is absolutely dependent upon it.

Good roads have brought a complete change in the whole mental attitude of our fellowmen who conserve the soil. He looks upon life and the world in altered aspect. He too can now conserve, conserve his energy, for he sees before him a long vista of good roads, which means a vista of peace and contentment. No longer must he labor and reap, work and toil against great disadvantages. Distribution can be made easier and cheaper. His products, his industries, can now be readily transported, for his roads are passable at all times of the year. He can haul nearly twice as much on a concrete road as he can on a dirt surface and make the trip to town and back in about half the time. All his perishable products of farm, garden and orchard can quickly be gotten to the market before they spoil. The results are inestimable. The quick and cheap government service, the Agricultural Parcels Post, expand his field enormously. Then, he too, can reckon on the increased value of his land, because of these improvements. Good roads are indeed a potent factor in conservation, they are an economic necessity; for our agricultural communities, our forest industries, our mineral resources are all dependent upon them in an inconceivable measure.

They also mean a conservation of human life and human intelligence. They mean conservation in an educational way for the farmer living in some remote section of the country, hemmed in by muddy roads, cannot educate his family, but against great, trying conditions. The school house surrounded by inaccessible walks, is more a hindrance, than a boon to child life. We must, through good roads, lift these future men and women of our rural and urban districts, from the miry depths of ignorance into the sunlight of knowledge, for no matter how much the State and counties appropriate for educational purposes, this cannot be accomplished unless the children and teachers have good roads.

With good roads, circulating libraries can easily be transported. The people will have their social centers. They can keep in touch with the daily life of the nation, and national opinion will not be restricted.

There is nothing so vital to rural life as good roads, nothing so vital to the welfare of the State and nation, nothing so productive to the development of the country.

The South is a great manufacturing section. Quantities of southern made goods are shipped to all parts of the country, our by-products of the mills, our pure foods, our machinery, our implements are all dependent on good roads. It is the one big question of the day in all lines of industrial endeavor. They will aid not only the rapid transportation of our timber, but will add to the economic utilization of wood and other forest products, and helps us to maintain supremacy of our great mineral production.

Think what they will mean to your marble industries, here in Georgia, to our marble in Tennessee, our coal, our wealth of iron. They mean the upbuilding of the South; the upbuilding of the nation.

Take our forest reserves for instance. We are all in favor of Federal control of our national forests—for our national forests are our greatest asset. The government, as you know, has an option on a tract of 6,000,000 acres in the Southern Appalachian region, in which purchases are to be made, and from which it will conduct its operation by building roads and driveways. What will be the result? This will mean forest institutes and the like, with a system of highways and good roads running through these national forests. The States and counties will construct links in between, thereby making a great highway, extending from near the National Capitol along these mountains to the southern end of the national forests in Georgia and Alabama.

This is coming right home to you my friends. With this system of roads and trails leading down to the streams, all of which we are conserving, with hotels, cottages, etc., there would be made easily accessible one of the most beautiful and picturesque mountain regions in the world.

The country is the nation's great recruiting grounds. What is it that has made the mountains of Europe the playgrounds of America? Why do our tourist spend months yearly in the Alps? Why is it they spend time and money in these foreign counties instead of in their own? Because those people have been far-sighted enough to enhance their natural beauties and to make them accessible by good roads. All over the Continent, will you find highways that make us blush with shame in comparison, public highways, that surpass our private roads and are as beautifully embellished as our city parks.

Good roads are a public health utility. They mean a conservation of life as well as of products, for rural isolation due to bad roads is a serious factor in inflicting disorder of the mind on women. They will mean a diminution of tenement life, for people will realize with good road facilities for transportation, the health giving life of the country.

They mean the reduction of the high cost of living; for our cities are dependent on the country for their products. They mean new life, new hopes, new ambitions.

There is no road so expensive as a bad road, and every county should build good roads; for much money is practically wasted in the process of road building, through inexperience, poor material and poorer labor. There should be greater efficiency in the distribution of funds for public road building, greater efficiency in the supervision. Remember the best is always the cheapest in the end and they who build the best roads, build a road of lasting prosperity. Build a good county highway and every village will have its main streets paved and good roads connecting with it. Pull the suburbs out of its muddy tracks and you will pull them into enlightenment. Give the people good roads and you will not only give them ideals, inculcate a love of home, a pride in their surroundings, but you will conserve the best interests of the people and lay an economic foundation that will benefit the country, the State and the nation.

I was asked "What have women to do with Highways Associations and the building of roads?" I replied, "Women have to do with everything that concerns the home and the future American citizens, and the question of good roads is of paramount importance to home life, to education and to health.

We should make for posterity a better abiding place, "Thy God bringeth thee into a good land, a land of rivers, of fountains, of depths that spring out of mountains and hills." Let us supplement this with a land of good roads, for conservation and good roads are the most urgent questions before the country today. They go hand in hand and will show how human efficiency may be effectively utilized and how many things, that now go to waste, may be converted into sources of revenue.

They mean a new era of prosperity to this country, where poor roads have long been the greatest drawback.

May good roads, foreordained by the wise action of today, be a practical consummation of a glorious tomorrow.

THE CHAIRMAN: "The Social Side of the Highway" is the subject of this next paper. Mrs. Haden was the former President of the Atlanta Federation of Women's Clubs, is now chairman of the Commission on Education of the Georgia Federation and is concerned in much of the good work being done in Atlanta. Mrs. Charles J. Haden.

THE SOCIAL SIDE OF THE HIGHWAY

MRS. CHARLES J. HADEN

Chairman Committee of Social Service, Georgia Federation of Women's Clubs

The road as a social factor may be of greater ultimate value than as a commercial quantity. The church, the school and the neighbor are the first formative influences in the building of the child after it leaves the nursery. The extent to which these may be made effective, very largely depends on the conditions of the roads.

The character of the highway itself is an object lesson which leaves a lasting impress upon childhood. Just as monuments and houses appeal to the childish imagination and suggest standards of life, so does the roadway. Is it well built, well kept, with appropriate bridges and sign-boards?—if so, it speaks thrift and stability, and a deep respect for the home-land. There is more than a surface meaning in the familiar lines "dear to my heart are the scenes of my childhood." A line of great oaks, or elms, that border the roadway imprints a subtle imagery upon the boy or girl that years do not efface. In the upbuilding of rural life, those things which charm and cheer the youth have a solid value which is too often overlooked. The houses, the roads, the fields and other early environment, become unconsciously the standards by which we measure

by comparison like things ever afterwards, whether they be better or worse, at home or abroad. They enter into and become a part of us to an extent that we do not realize until when in mature years we detect how they influence our conduct.

The modern roadway lures the city dweller to the country, creating a counter-current against the call of the foot-lights and the white way. Carried out by motor cars, the educative forces of the city reach the hundreds of homes which were marooned by the old time mud-obstructed roadway. The book, the magazine, the newspaper, the fashion, the miscellaneous emanation which gives sparkle to city life, transforms the one-time monotony of the farm. The drudgery which in former times made dull and drear the farm and drove away from it too many of its boys and girls, is changed by the incoming of labor-saving devices. Through these the earning capacity of the farm is multiplied and the hours of rest increased. Less drudgery and more leisure develops the finer qualities of a people and enriches their social life. These follow the construction of good roads as day follows night.

The rural home-maker finding that city tourists are passing her gateway every hour, naturally yields to the woman's instinct to beautify her surroundings. The custom is both universal and wholesome to add attractive touches when company comes. This initial step of home-pride is followed by other steps of domestic and social advancement. The girl and the boy of the road-side home meeting every day the passing tourists, absorbs elements of a practical education which otherwise would be lost to them.

A rural movement fast becoming nation-wide, is the organization of community clubs. These meet once each month at a home of one of the members, so that during the year, each member has been host at least once, to the club. A study of public questions, of agriculture, of coöperative buying and selling, of fraternal interest, has made these organizations of immeasurable benefit to country life. These clubs are made possible through the winter by good roads; and it may be added that, in hundreds of instances, good roads have been made possible only through the influence of these clubs. These rural clubs, coöperating with each other and with schools of agriculture, have studied the secrets of the soil increasing the earnings of the farmer, and broadening the social opportunities of his family. It has been long recognized that the deep-laid foundations of England's national life are its country homes. The Englishman *lives* by the highway, he merely *sojourns* by the street side. Away from the turmoil of the city and surrounded by the meadows, the Englishman reaches the fullness of his stature in his Thorny Croft, or his Locksley Hall. Under such environment love of the country, is love *for* one's country.

Without the passable roadway we lose our greatest birthright—pure air and abundant sunshine. In the construction of sleeping cars there is a certain scientific minimum of breathing space for

the protection of health; it is equally well recognized that the best protection against social ills are the larger breathing places along the country highways. All deplore the overgrowth of the cities, but this trend of our times seems without remedy. Now, as in the past, the city is reinforced by recruits from the country. The wise thing is to raise the standard from whence these recruits come, not only to better equip those who leave, but to increase the number of those who remain. This is the undertaking for each separate country home and may be best accomplished when country homes, one with another, are close knit into a social fabric. The telephone along the roadside, the metal reservoir conveying water by gravity through every room, electric or acetylene lights, the daily rural mail delivery, the small automobile; these can lighten the one-time burden of the farm and brighten its one-time dullness and transform a whole country into a neighborhood. They follow and depend upon the improved highway. It is not that we need to meet people every hour—indeed it is better that we do not meet them every hour—but that we can meet them when we should and meet them with comfort, that develops social life at its best. Keeping busy at something both useful and agreeable is a later accomplishment of the city woman. This has been found to be the greatest youth-prolonging influence ever discovered. Adopting this discovery the women of the city have united in many organizations for civic and social service. They have served the public well, but in doing so have served themselves better. The highway with its accessions puts at the command of the women of the country the same opportunity of taking the drudgery out, while they still keep busy at something both useful and agreeable. One is work with the sparkle out, the other is work with the sparkle in.

The railway train is of the town and for the town. It steams across the country along its narrow right of way with hardly more of human fellowship than an aeroplane or a meteor. But the improved roadway establishes a *social level*. The humblest cottager feels in it a sense of partnership—that it *leads him somewhere, and brings him something*. The school boy with his books, the woman at the well, and the man with the hoe give and receive the salute as the motor car whirls along. The country store and the wayside inn, give and take the glad hand with the tourist. Between the driver on the hay-wagon and the millionaire in his touring car the pure democracy of the pioneer republic for the passing moment lives again. In touring across New England during the past summer, the cottager woman who kept the toll-bridge which spans the Connecticut River where it divides the mountains of Vermont and those of New Hampshire, told us that within two hours that day she had talked with tourists from Canada, New York, Texas and Georgia. With two small children clinging to her skirts she said to us, with a goodbye wave of the hand, "You know, we are all neighbors now."

It is one step—a kind of graceful, sliding scale—by which the

tree-bordered avenue stretches into the tree bordered country road. The reasons for the one are the reasons for the other. Beauty, comfort and relief from monotony. The cost of planting and keeping shade-trees along the highway is hardly perceptible. Sunshine and clouds give like spendthrifts, the blossoms of spring and the brown leaves of autumn are semi-annual dividends declared by mother nature, and the added growth as year follows year, is the ever increasing patrimony which one generation bequeaths to another. Such will be the highways of the future as the women of our land become more and more concerned in its outdoor civic welfare and cause our road-builders to reckon on the commercial value of beauty. In France and California, the charm of the roadway attracts tourists from all parts of the world, tourists who spend unsparingly of their money and their time.

As a beautiful gown calls for appropriate accessories until the ensemble is complete, so will the shade trees of the highway call to their support the grassy lawn, the rose garden, the artistic touches of house and out-buildings, until the domestic scene has been made anew. The modern roadway will lead us back to the social supremacy of the country as it is in England and as it once was in the old South; and these things are coming as by the swift speed of the motor car, city comforts are carried to the country home.

In the pioneer days, the winter solitude of the country was severe in the extreme. The farm home from December to March was but little more of a social center than was the island of Juan Fernandez, with Robinson Crusoe and his man Friday. Mud put an embargo on travel, except when under compulsion, for a hundred days of the year. It must have been when looking from a farm house window upon a January landscape of gloom and chill, overhung with lowering clouds, that the great author wrote "Now is the winter of our discontent."

It has been these "winters of discontent" that has driven much of the best citizenship of the country into the towns, during the past two generations, an exodus causing a melancholy decline in many parts of American country life.

The trolley car, many years ago, began the extension of urban boundaries; then came the automobile putting further from the soot and noise, the home of the city family. Now, in the more thickly populated States, where the towns are near, it is hard to tell where the city ends and the country begins. The business man indulging in his fondness for amateur agriculture, is helping the fortunes of the real farmers on the adjoining farms. A comradeship has grown up among these new neighbors; the man of the city is absorbing the thoughts and habits of the country; and the man of the country is taking up the thoughts and the habits of his city friend. It is a new social melting pot, out of which we are moulding a vigorous manhood. The tension upon the man from the office is loosened, and the man at the plow acquires a more definite aim and

precision of purpose. The drudge worn look of the farm house gives way to the shrub, the vine, the varnish and the paint, and the woman of the farm house is refreshed by the thought that she is in touch with the world.

The wayside home is passing through a period of transition. Science is softening the hardness of farm life. The work remains, but the toil is growing less. By telephone, the house 10 miles distant is nearer in wintry weather than the town neighbor several blocks away in former years. By the motor car, 5 miles is closer the railway station, than by horse drawn vehicle over a bad road 1 mile.

In Baltimore, within the last few years, the old aristocratic quarters of the city have been practically abandoned, because the residents have built their homes from 5 to 15 miles away, mingling country seats with farms. The grassy lane has become an avenue, and the old post roads widened into boulevards.

History has placed in the first rank the men who build cities. But in modern times too much city has disturbed both our social and economic equilibrium. The man of the hour—the hero of the day—is the man who builds a country. The magician of our times whose miraculous touch restores the poise between city and country life is the road-builder. It is he who is strengthening the social ties, and is making a neighborhood of a nation.

THE CHAIRMAN: It gives me much pleasure to introduce Mrs. Sheppard Foster. Mrs. Foster is the former State regent of the Daughters of the American Revolution and represents the National Old Trails Road Committee of that great organization.

NATIONAL OLD TRAILS ROAD

By MRS. SHEPPARD FOSTER

I appear before this Good Roads Conference in behalf of approximately 100,000 women, the Daughters of the American Revolution, and as the representative of Miss Elizabeth Butler Gentry, National Chairman of the Old Trails Road Committee, who extends best wishes to this conference and regrets exceedingly she cannot be present. As her deputy I take pleasure in bringing to your notice our bill, introduced by Mr. Borland, January 15, 1911, known as the Daughters of the American Revolution Old Trails Act or H. R. 2864. This bill provides for the construction of a National Old Trails Road—the ocean to ocean highway proposed as a national memorial road by the National Society of the Daughters of the American Revolution. We seek your support and coöperation for this measure for you know it has been said "What woman wishes, God wills."

In 1910-11 Mrs. Robert Oliver, State Regent of Missouri, appointed Miss Elizabeth Gentry of Missouri, Chairman of the State Old Trails Road Committee, whose duty it was to urge a State

highway across the State following two famous old trails. At Miss Gentry's request Governor Hadley of Missouri dedicated this road and named it the Old Trails Road. Miss Gentry is now chairman of a national committee in the Daughters of the American Revolution, 1000 strong, representing every State in the Union, actively engaged in creating public sentiment for this road. Through the courtesy of the Century Company, the Madonna of the Prairies, renamed the Madonna of the Trail, has been adopted by this committee as its symbol.

Already this ideal and sentimental project, initiated and organized by the Missouri Daughters of the American Revolution, has been endorsed by the Trans-Mississippi Congress, the Association for Highway Improvement, the National Old Trails Road Convention, the American Road Congress, and the United Daughters of the Confederacy. The National Old Trails Road Association was formed at a national convention at Kansas City, April, 1912. As stated in its By-laws, it was "formed to assist the National Society Daughters of the American Revolution to carry forward its purpose of making the National Old Trails Road the National Highway." This organization of men has over 7,000 members and handles the business and practical side of the question while the Daughters of the American Revolution handle the historic and sentimental side. Judge J. M. Lowe, of Kansas City, is President of the Association.

The Daughters of the American Revolution were the first to think of a national memorial highway, spanning the continent. In each State they are trying, as we are here in Georgia, to preserve by means of good roads, the local history. But they are all concerned together in the preservation, by the National Old Trails Road, of the history of our country. Now is the time when a great scenic and historical highway will do most for America for the reason that at present Americans must stay at home and "see America first." There are many road bills pending in Congress and we admit the necessity for all of these diverging highways. Nevertheless, because our great road in the next few years will have an unprecedented opportunity to teach American history to Americans and because we claim priority for the idea of a transcontinental highway we want our great ocean to ocean road built *first*.

Our organization has for one of its laudable purposes "to aid in securing for mankind all the blessing of liberty." Is it not doing this by advocating a bill for a national highway from ocean to ocean, not only teaching our country's history to natives and foreigners alike, but thereby securing the betterment of country life? Our plan has a social and political as well as an economic value, for our road is made up of several old trails that speak one by one of the advance of opportunity, civilization, religion and romance, across our continent.

This road will also make accessible our beautiful American scenery. It is estimated that approximately from \$250,000,000 to \$300,000,000

is left annually in Europe by Americans—no doubt more than this amount was left this year. We have a great opportunity now to keep our people at home, so why not make home as attractive as other countries? The Swiss Alps, with its picturesque lakes, do not eclipse the grandeur of our Wyoming and Colorado scenery, and Yellowstone Park, with its phenomenal geysers and other beauties, and the Grand Canyon of Arizona have no rivals.

It is the purpose of each State, through which this road passes, to make it typical of that State, not only by bringing attention of the tourists to the history of the State, but to where native animals, trees, etc., may be seen; to State museums, where objects of local interest are collected and preserved; and to old taverns of coaching days. This road has been called "Peacock Boulevard," but along this boulevard you may not only see (may I say) beautiful "peacocks," but "you can delight in the canvas back ducks and oysters of Maryland, the beaten biscuits and fried chicken of Virginia, the Missouri apple, the Kansas corn and the venison steak of the Northwest as well.

The outline of the National Old Trails Road you will find traced across this map. Here are the old Washington Road, the old National Road or Cumberland Pike, the Boon Lick Road, the Santa Fe Trail, Kearney's Road and the Oregon Trail. The Washington Road was traversed by General Washington to and from his several inaugurals as President of the United States and the Braddocks Road was traveled by General Braddock in his campaign against the French and Indians in 1755. The States crossed by these pioneer trails are Virginia, Maryland, Pennsylvania, Ohio, Indiana, Illinois, Missouri, Kansas, Colorado, New Mexico, Arizona, California, Nebraska, Wyoming, Idaho, Oregon and Washington. The road is open all the year, and is even now ready for tourists to the Panama Exposition. There are hotels and garages the entire length of it, easily reached during each day's travel. The larger portion of it is now a dirt road, with concrete bridges and culverts. When the government takes it over it will be macadamized or concreted.

Modern travel demands clear road signs to mark the roads and travel goes to the well graded and well marked roads. The sign for our Main Road is composed of red, white and blue bands, each four inches wide and eight feet from the ground. It is surmounted with the Daughters of the American Revolution Insignia and the name, National Old Trails Road.

I have given you briefly an outline of the proposed National Highway of the Daughters of the American Revolution, and I wish particularly to impress upon you that in doing so I am simply the mouthpiece of the national committee. The committee wants your support because this Old Trails Road is the most practicable outline for an ocean to ocean road yet suggested, because its connection links are made up of old roads and trails that are replete with history, and because there cannot be a route which would be of more picturesque and historic interest.

The old roads have been marked with the crimson blood of our forefathers who through their heroic deeds and sacrifices, blazed the pathway of American civilization and their history is filled with sacred reminiscences. The Daughters of the American Revolution ask you to lend your influence in behalf of our Old Trails Road Bill as a fitting memorial to our pioneer patriots.

THE CHAIRMAN: After such an interesting paper it is rather difficult to explain the attitude of this new woman's department to these specific highways. Especially after the delicious *menu* offered by the National Old Trails Road! This department, of course, is heartily in sympathy with good roads everywhere that they serve the demands of present day traffic and is deeply sensible of the charm of sentiment and association which clings about the old trails. These transcontinental highways and all others ought however to be built by skillful men, under efficient and economical management, and all the various sections of these costly roads should be permanently maintained after they are built. Under our present State systems of road management from 20 to 40 per cent of the road funds are wasted. How much better to stop this enormous leak before pouring out further great streams of money for the roads.

The Woman's Department begs the assistance of all patriotic women to make our road management as efficient as the management of any other big modern business. Then there will be money enough in State treasuries to build the different sections of these splendid roads at the smallest cost and with the least expenditure of time and effort.

It is much to be regretted that the fine addresses of Mrs. Nellie Peters Black of Atlanta, Mr. Sidney Suggs, State Highway Commissioner of Oklahoma, Mr. Wm. R. Roy, State Highway Commissioner of Washington, Mr. J. E. Pennybacker, Chief of the Division of Road Economics of the U. S. Office of Public Roads and Professor Agnes Ellen Harris were not reported. Mr. Pennybacker, who officially represented the Office of Public Roads of the Department of Agriculture, gave an illustrated address showing how women can best aid the movement for better roads. Miss Harris who is the leader of the Canning and Poultry Club work of Florida and professor of Home Economics in the Florida State College for Women, officially represented the farm demonstration work of the Department of Agriculture at the Women's Conference on Roads. The subject of her very delightful address was, "The Road, an Opportunity."

ANNUAL MEETING OF THE AMERICAN HIGHWAY ASSOCIATION

ATLANTA, GEORGIA

November 12, 8 P.M.

President L. W. Page in the Chair.

The meeting was called to order by the President, and the minutes of the last meeting read and approved.

The Secretary presented his report for the year, and also the report of the Treasurer, the latter official being absent. The Secretary reported that 520 new members had joined the Association since its last meeting; that a most important step had been taken in the establishment of a Woman's Department, and that the financial affairs were in an unusually satisfactory condition, there being a balance on hand of \$6,868.26. He also reported that the 1914 edition of the Good Roads Year Book and the Proceedings of the Third American Road Congress had been issued during the year, distributed to members of the Association, and a large number sold.

On motion of Mr. MacDonald, duly seconded, the reports of the Secretary and Treasurer were approved.

THE PRESIDENT: Gentlemen, there is an amendment to the constitution to come up for action tonight, of which due notice has been sent you by the Secretary. I will ask Mr. Pennybacker to read the amendment.

SECRETARY PENNYBACKER: Mr. President, the purpose of the amendment is to make all officers except President, Vice-President, Treasurer and Directors, appointive by the Executive Committee. The amendment, if adopted, will read as follows:

Article V (as amended)

Section 1. The officers of this Association shall consist of a President, a Vice-President, a Treasurer, and a Board of Directors, consisting of the President and Vice-President of the Association and twenty-three additional members, to be elected at the annual meeting of the Association as hereinafter provided, and such other executive officers as may be appointed by the Executive Committee.

Section 2. The President, Vice-President, Treasurer, and members of the Board of Directors shall be regular or sustaining members of the Association, and shall be elected at the first regular meeting and annually thereafter, except that the members of the Board, exclusive of the officers, shall be elected in three groups, the first to hold office for a period of three years, the second to hold office for a period of two years, and the third to hold office for a period of one year, vacancies on the Board to be filled annually thereafter.

On motion of Mr. Diehl, duly seconded, the amendment was adopted.

THE PRESIDENT: Gentlemen, the next business before the meeting, is the election of officers for the ensuing year.

MR. J. E. PENNYBACKER: Mr. President, I move that a nominating committee of seven be appointed to consider nominations and bring in a list of nominations for all officers and directors to be elected at this time.

The motion being duly seconded and carried, the President appointed the following committee on nominations: Messrs. Parker, Diehl, Suggs, Beatty, Mehren, Pierce and Rader. The committee then retired.

THE PRESIDENT: While our Committee is conferring, I wish to say to you that I appreciate in the highest degree, the splendid support that you have all given to our work of the last four years. I think a great deal has been accomplished. One of the most far reaching results which our meetings have been instrumental in bringing about, was the formation of an organization of State highway officials. There are so many people throughout the country that have helped in the work during my term of office that it would be impossible for me to thank each by name, but I take this occasion to express my deep appreciation of this splendid coöperation. I might mention another project of importance that we have inaugurated this year, and that is the formation of a Woman's Department of the Association. We all know how deeply the women have stirred the public mind in their propaganda for prohibition and suffrage, and I believe that an equal amount of energy exerted by women to bring about better road management throughout the United States, will be most productive. We all know that if a man begins to talk reform in road work in our counties, the men smile and say he is going to run for the legislature next year or for Congress. Now that is not the case when women take up the work. I have asked the women who have engaged in this work, in organizing their respective counties, to take up three questions; how much money are we spending in our county on roads; where are we expending this money; and, how are we expending it? I think if these three subjects are seriously considered in our counties, we will ultimately accomplish a great deal in the way of results. I see Mr. Fletcher of California, President of the Congress here, and I know we should all like to hear something from him.

MR. FLETCHER: That is a very sad joke; I can't make myself heard, because of my hoarseness. You will have to excuse me.

MR. BOORMAN: I think we ought to hear from our friend Smith in regard to your splendid remarks on this women's work. Mr. Smith helped in inaugurating their first meeting. I only regret

that the press of the country have not heard the magnificent speeches by those noble women.

MR. PRESIDENT: We would like very much to hear from Mr. Smith.

MR. SMITH: I think that Mr. Boorman had better continue the argument himself. I said in my speech to the good ladies that I thought it was a great day when you organized that department to get the women of the country interested in road building, and eliminate the political side of the question. I am sure that their efforts will bring substantial progress in road building. Women are the leaders in almost everything else. They are taking a great hand in education, they know how to do things in detail much better than men, and I am sure you haven't done anything in all your administrative actions greater than the establishment of this department, and I look for great results, if maintained and worked out along the lines that you have suggested. I wish we could get the benefit of them in Georgia. I hope that the Georgia women will take up this question and find out, as you suggest where we are spending this money and for what? In my own State, I find that great sums are being wasted. We have no organization. We are all acting independently of each other and with no definite system. We should have a Highway Commission whose knowledge would help us to get results. The State of Georgia gives us 5000 convicts to work, but mark you, we have not learned how to work them to the best advantage. We want engineers who can figure out some material along our roadsides that we can put into our roads and make a winter road. I wish, at your next Congress, that you would devote more time to this question of material. We are relying now on Professor Strahan, from the State University, to give us the information and he has helped us wonderfully.

MR. PRESIDENT: Gentlemen, this year we lost one of the greatest men, in my judgment, who has ever been connected with the road movement. I know when I first took the subject up and we decided to form our organization, I went to Mr. Alfred Noble, whom I consider one of the greatest engineers this country has ever produced, talked the situation over with him and he urged me to proceed with the formation of this organization. From the very inception of the work he gave us valuable advice and generous financial support. I think it was the darkest moment of our existence when he died. I know I felt his loss very keenly and I hope that one of you will move to appoint a committee to draw up suitable resolutions upon the death of Mr. Alfred Noble.

MR. BOORMAN: I attended the funeral services of that great engineer held in the Cathedral of St. John, on Morningside Heights, surrounded with everything that was beautiful, everything that

was lovely, everything that was uplifting. I met there gentlemen like our distinguished friend the city engineer of New York, men well advanced in life came up to pay their last respects to the memory of Alfred Noble. I feel that I can say and we can all say that Alfred Noble was called to his eternal rest after a life that could not be more full of noble and great works. To men like him we must look up and try, if we can, to emulate their noble acts. It is most eminently proper that a committee should be appointed to draw up suitable resolutions in memory of our great engineer, and I move, Mr. President, that a committee be appointed.

MR. PRESIDENT: We have also, during the past year, lost another member of our Executive Committee, Mr. W. W. Finley, President of the Southern Railway Company. It was Mr. Finley who first urged me to start this association, and to the day of his death was one of its strongest supporters. I hope that the motion will include both Mr. Noble and Mr. Finley.

MR. BATCHELDER: Mr. President, I make a motion to that effect.

The motion was seconded and adopted.

MR. PRESIDENT: Gentlemen, I will appoint on that committee Messrs. Charles Whiting Baker, Wm. D. Sohler and A. B. Fletcher. I see right in front of me my old friend Commissioner MacDonald of Connecticut, and while we are waiting for the committee on nominations I hope he will give us a few words.

MR. MACDONALD: *Mr. President and Gentlemen of the Association:* I think it would be highly proper for me at this time to endorse the new auxiliary to our work, the ladies. I know that in the early days of my struggles as highway commissioner the most valuable assistance that I had in my town meetings throughout the State where the propaganda had to take place, was the ladies. It was a sort of house party, and I know in one little township the young ladies gave a minstrel performance. They blacked up and attracted a purse of some \$800 with which they built walks all through the village. The young men sought to emulate their example and got up a show, but they didn't get but \$400. Now, over in my State, if we want to lift a mortgage on a church, we appoint a committee of ladies and we worship God in a house without debt. If the horse shed leaks, we don't have any trouble about getting a dry roof when we appoint a committee of ladies to take care of it. Mrs. MacDonald went to this ladies meeting the other day, and has attended some of the sessions here that we have had this week. She said she wished that the delegates could have been present at that meeting of the ladies and heard them discuss this great question of highway improvement. The dispatch with which they took care of the business of the hour and the comprehension that the ladies show in regard to this great question, would, she said, have been a

great lesson to us, not only in the conduct of our convention, but also in the subject matter discussed. I told her I rather thought that was a lady's point of view, but she said she was sorry I had not been there for I would have had the same opinion. I believe that our organizations, throughout the country, for highway improvement would be materially strengthened if we had the ladies join the organization. The great thing that we will have to contend with, gentlemen, in the future, in my judgment will be predatory interests, commercialism and politics, as the most destructive force in highway construction. Poor construction will not begin to have the influence in comparison with the three things which I have mentioned. This Association and all other associations that have to do with this great question, need to be intrenched, organized deeply. There is no doubt but what the splendid session that we had the other day on the merit system is one of the greatest questions of the hour. We should have it. One of the greatest assets of that splendid organization, the A. A. A., is that they are loyal and faithful, have a united interest, and are one for all and all for one. There should be one great organization throughout this country that should have for its purpose the keeping of men in office irrespective of politics or any other influence that you might name, just so long as they are worthy and well qualified to fill the position. It is not enough to have all the money that is necessary with which to construct roads, it is not enough to have executive ability to organize a great force, it is not enough for me to know how, but greater and better than all, is the question of economics, how to spend every dollar so that there will be an equivalent for that dollar which you have expended. I am very glad to see this great organization that we have indoors and outdoors, with all their tools and implements and material. We need every one of them, and I am very glad to notice that today and yesterday there was some attention paid to this great question, the foundation of road building, the dirt road, the question of drainage, the question of grading, the width of road, the cycle, the question of straightening a road and all those auxiliaries, and this, gentlemen, right here in Georgia where you have 82,000 miles of road and 52,000 square miles of territory and just 4800 miles of improved highways. What are you going to do with the rest of them, the dirt roads? There is not enough attention paid to the little details of road building; there is too much attention paid to the question of refinement; what you want just now is a deeper insight into the little things, the depth of the road. We very wisely saw that with only 10 per cent of the highways of this country improved and 90 per cent still lying in the mud, that it was a great question how to take care of that vital problem of starting with the earth roads, and what you want to learn is how to properly incorporate the clay and the sand and wait until the day comes when you can take up the higher branches. In my own State I had a thousand dollars which I had to divide into eight parts, and I remem-

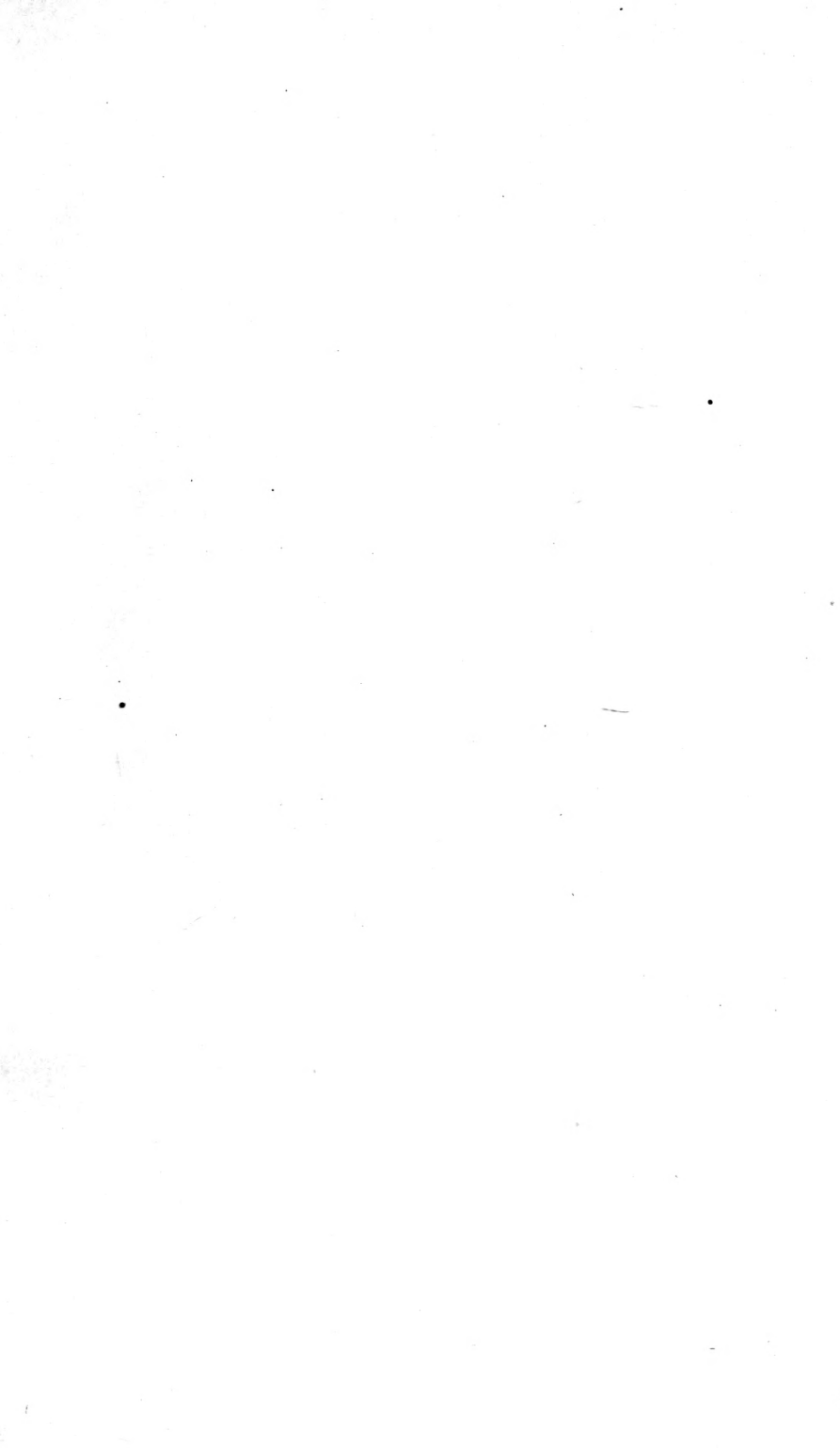
ber going out and pacing over the road without even a tapeline and then sitting down on the side of the road figuring it up and letting it to the selectmen of the town to do it, and was severely taken to task by some of the engineers on the ground that I was interfering with their business. I said, "Watch me, boys; they only had \$1000, in some places, and \$500 in others, and you will see they will come into the movement." The next year 32 of those townships came in for \$9000. That was the result of starting with the little ones. We cannot all have jewelry for our wives and so it is going to be all through this great country of ours. The vital question for us all to take up is, let us do whatever we have to do with our hands with all out might and have an eye single to what is best all over the country, and let us see to it that we stand together for honesty of purpose and good intelligent management of everything that may be placed in our hands. I thank you.

Mr. Fletcher takes the chair.

At this time the committee on nominations submitted the following report: for President, Fairfax Harrison; Vice-President, Logan Waller Page; Treasurer, Lee McClung; Directors for three years, A. G. Batchelder, Bryan Lathrop, W. Tom Winn, Charles E. Blaney, William D. Sohler, S. E. Bradt, and Richard H. Edmonds; E. J. Mehren to fill the vacancy caused by the resignation of Jesse Taylor whose term would have expired in 1915.

On motion of Mr. Batchelder, duly seconded, the report of the committee was adopted and the Secretary directed to cast a unanimous ballot for the election of the officers named.

No further business appearing the meeting adjourned sine die.



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